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WORLD PETROLEUM

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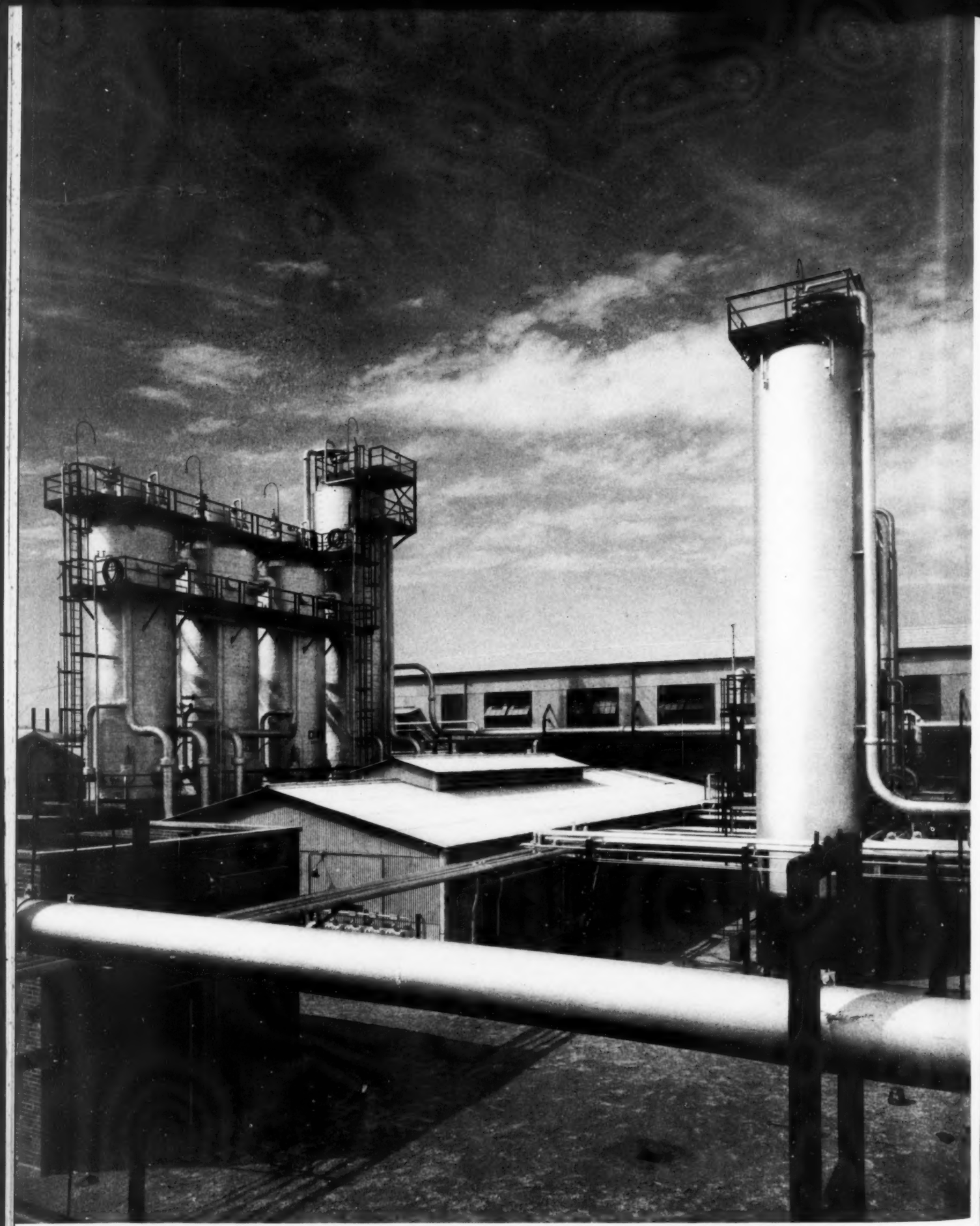


Above, general view of the deasphalting and dewaxing units at Shell's Wood River refinery: Front cover shows the Clear Ridge cut on the recently completed Pittsburgh-Harrisburg Turnpike (story on page 56)

EDITORIAL

AMERICAN PETROLEUM INSTITUTE--AN ORGANIZATION FOR SERVICE

THE annual meeting of the American Petroleum Institute in Chicago this month marks the completion of a cycle in the history of that great organization. Its establishment was an inspiration springing from the united, enthusiastic and highly essential contribution of the petroleum industry toward the winning of the first world war. Today it is providing leadership for another task of equally vital import and of even greater dimensions in support of the national defense. In between is a long record of service to the oil industry, the government and the American public.

The petroleum industry never has failed to respond promptly to any call to aid the public welfare. Equally important, it has always been ready with the men, the products, and the facilities to answer such calls effectively. In a national emergency good will and good intentions are of little avail unless they can be translated promptly into deeds of practical worth.

It is significant of the purpose and spirit of the American Petroleum Institute that the very first of the declared objectives set forth at the time of its inauguration was "to afford a means of cooperation with the government in all matters of national concern." How well this promise has been kept the record of the intervening years reveals. When the Navy asked for use of tankers or special storage facilities, the oil industry supplied them. When fuel of higher quality than any yet available was required by the air force of the nation, the research workers of the industry provided it. When the federal government summoned the oil men of the country to aid in fighting depression by submitting to a form of regimentation foreign to their habit and belief, they responded loyally. In all of these undertakings, the Institute's part was to provide a ready means of obtaining action, of marshalling the forces within the industry and of reflecting the sentiment of the rank and file of oil men who comprise its membership.

The petroleum industry has rendered an inestimable service to the consuming public in the past twenty years by steadily improving the quality of its products and at the same time, vastly reducing their price. Today, for example, a gasoline of quality superior to any heretofore offered the motoring public is being purveyed at approximately half the unit price charged for a greatly inferior grade twenty years ago. To this advance in quality and decrease in cost, the Institute has contributed both directly and indirectly by the research which it has itself conducted and by its constant encouragement to independent research among its members. The meetings of the Institute and of its divisions and local chapters have become primarily gathering places for their interchanging of ideas and of their fruits of study, observation and experiment as to better ways of doing things and methods of obtaining better products. This spirit of progress forms the keystone of the Institute's activities.

The Institute's services to the industry have been too multifarious even to be catalogued here. They are recorded in the work of hundreds of committees, in its voluminous publications and in the results of the studies which it has sponsored and directed. To practical oil men perhaps nothing that it has done is of greater usefulness than its broad work for the standardization of equipment. To operators in fields which often are beyond quick communication the importance of being able to make replacements with parts of standard size cannot be overestimated. In the days when every manufacturer made casing, pipe threads and connecting parts to suit his own fancy, delays due to inability to fit spares sometimes led to irreparable loss or damage. Today, thanks to the systematic work of standardization which the Institute has carried on from its inception and which is still going forward, the oil operator, in whatever part of the world he may be, orders his equipment according to "API specifications" and is sure that it will fit his needs. Such world wide recognition is a tribute to the efficiency with which this all important task has been carried on. It is estimated that it saves operators throughout the world $15,000,000 a year and it is of course only one of the many constructive activities in which the Institute has engaged.

While referring to the things that the American Petroleum Institute does, it is perhaps worth while to glance briefly at what it does not do. It does not attempt to influence in any way the manner in which its members conduct their individual businesses. It stands for conservation of resources, sound methods of development to insure maximum recovery from producing fields and avoidance of all forms of waste, but it makes no effort and has no authority to enforce such practices. It collects and disseminates statistics as a matter of record and for the information of press and public, but it has no power or disposition to influence the operations that produce these statistics. It issues no orders and has no disposition to tell its members how to run their affairs. It has no concern with the setting or changing of prices. If the well owner acts in such a way as to dissipate his resources, operates at a loss or even obstructs others who are endeavoring to promote sound methods and stability, then the Institute will not say him nay. Such matters are outside its sphere.

Primarily the Institute is a forum for the interchange of ideas, a clearing-house for information and a cooperative agency for the encouragement of technical progress. It is a focal point for mobilizing the resources of the petroleum industry for national service. It has no secrets and its operations are all conducted in the full light of day. By adhering to these safe principles the Institute has been able to exert a profound influence toward the scientific advancement of the industry and the enhancement of its ability to serve the nation.

Contrary to widely held belief, the American Petroleum Institute is not an aggregation of companies, but is made up of individuals representing every branch of petroleum activity from field man to corporation head. Built on the truly democratic principle, it includes in its membership, directorate and council, men who differ strongly on many questions of trade policy, but who can work together for national strength and technical progress as to which there can be no division of views. Proceeding along this line, the Institute has become one of the strongest and most influential bodies of its kind to be found anywhere. Any other course would have wrecked it long ago in an industry so strongly individualistic, so fiercely competitive and so determinedly independent as the democracy of oildom.

FUNCTION OF A PETROLEUM INSTITUTE

DISCUSSION of the work, progress and objectives of the American Petroleum Institute directs attention to the proposal for establishment of a South American Institute of Petroleum which is the subject of a communication on another page of this issue.

The project for such an organization was outlined at some length in World Petroleum of September last, based on a paper prepared by Dr. C. R. Vegh Garzon, managing director of A. N. C. A. P., national refinery of Uruguay. The reasons adduced by Dr. Vegh Garzon as justifying the formation of a petroleum institute in South America were (1) the growing importance of that continent in the petroleum industry, with an annual output approximately 13.60 percent of the entire world production, and (2) the fact that oil companies operating in South American countries have interested themselves in familiarizing the nationals of those countries with operations relating to the production, transportation and refining of oil, so that there is a growing number of engineers who could profit by the interchange of ideas on the technique of petroleum operations.

These appear to be sound reasons and the content of the article indicated that the proposed institute was to be modeled more or less on the Institute of Petroleum in England or the younger but equally influential American Petroleum Institute. Another petroleum engineer who has spent many years in South America and is familiar with developments there now writes criticising the projected South American Institute on the ground that the purpose of those promoting it is to make it an instrument for encouraging the nationalization of the oil industry in all South American countries.

Without attempting to pass upon the merit of the discussion from this distance, it may be said that an organization of technical men which espouses political objectives is almost certain to suffer a loss of respect for its scientific and technical standing. The two purposes do not mix. The Institute of Petroleum, which draws its membership from all parts of the world, and the American Petroleum Institute which is made up of oil men of the United States, Canada and Mexico, have attained a high standing and have contributed greatly to the progress of the petroleum industry because they have confined themselves to technical problems, using that phrase in a broad sense, and have eschewed political activities which are bound to create controversy and disunion. We believe that if those who wish to create an organization of South American petroleum engineers, chemists and geologists, desire it to rank with the other great institutes mentioned, they will be well advised to direct it along the same lines of technical progress and industrial advancement and to renounce political objectives if such are in view.

TWENTY YEARS OF THE A. P. I.

Born of Wartime Service the Institute Has Made Great Contributions to the Industry, the Nation and the Consuming Public and Now Stands Ready to Render Vital Aid to the Cause of National Defense.

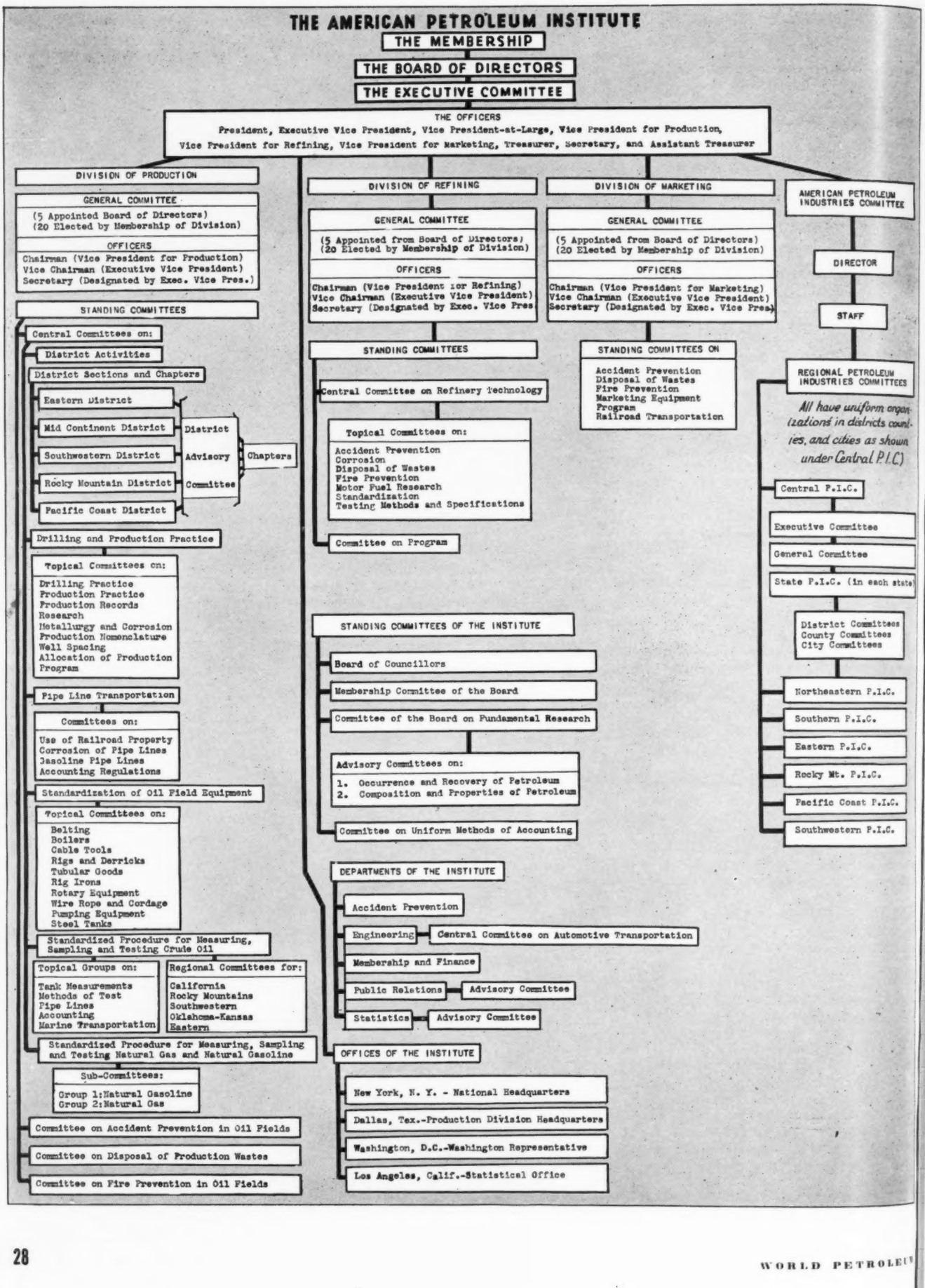
Above, Axtell J. Byles, president of the American Petroleum Institute since 1936 with William R. Boyd, Jr., secretary. Below, Thomas A. O'Donnell, California oil pioneer, first president of the A. P. I. from 1919 to 1924.

THE American Petroleum Institute was organized in 1919 by the men who served on the National Petroleum War Service Committee and its sub-committees. Historically a Petroleum Committee was organized by invitation of government agencies soon after the United States entered the World War in 1917 to cooperate with the federal Council of National Defense. The chairman was A. C. Bedford, president of Standard Oil Co. of New Jersey. The original members were: E. C. Lufkin, president of The Texas Co.; George S. Davison, president of Gulf Refining Co.; E. L. Doheny, president of Mexican Petroleum Co.; J. W. VanDyke, president of The Atlantic Refining Co.; H. F. Sinclair, president of Sinclair Oil & Refining Co.; and John H. Markham, oil producer, of Tulsa, Okla. Later H. G. James, president of Western Petroleum Refiners Assn., and William Muir, president of Crew-Levick Co., were added to the membership. James A. Moffett was named secretary.

One of the first tasks of the committee was combating theories that some compulsory steps must be taken to make certain that wartime needs for petroleum and its products satisfactorily and adequately would be met. The Committee, through its chairman, voiced the attitude of the industry in a statement explaining that with the war being fought for democracy "it would be a thousand pities if, in the stress of such a war, we should put bureaucracy on the throne and choke out those opportunities for the play of individual initiative, enthusiasm, and efficiency which must always be the glory of a democracy."

Late in 1917, Joseph M. Guffey, a Pennsylvania oil operator, was appointed "Petroleum Administrator" by the War Industries Board established by the federal government of which Bernard M. Baruch was chairman. The administrator, charged with purchasing petroleum products for government use, later was succeeded by A. C. Woodman, of Union Petroleum Co.

In December 1917 the Council of National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Southwestern District
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Drilling Practice
Production Practice
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Metallurgy and Corrosion
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Topical Committees on:
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Cable Tools
Rigs and Derricks
Tubular Goods
Rig Irons
Rotary Equipment
Wire Rope and Cordage
Pumping Equipment
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Tank Measurements
Methods of Test
Pipe Lines
Accounting
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Rocky Mountains
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Committee on Disposal of Production Wastes
Committee on Fire Prevention in Oil Fields
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STANDING COMMITTEES
Central Committee on Refinery Technology
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Accident Prevention
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Testing Methods and Specifications
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(20 Elected by Membership of Division)
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Chairman (Vice President for Marketing)
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Secretary (Designated by Exec. Vice Pres.)
STANDING COMMITTEES ON
Accident Prevention
Disposal of Wastes
Fire Prevention
Marketing Equipment
Program
Railroad Transportation
AMERICAN PETROLEUM INDUSTRIES COMMITTEE
DIRECTOR
STAFF
REGIONAL PETROLEUM INDUSTRIES COMMITTEES
All have uniform organizations in districts counties, and cities as shown under Central P.I.C)
Central P.I.C.
Executive Committee
General Committee
State P.I.C. (in each state)
District Committees
County Committees
City Committees
Northeastern P.I.C.
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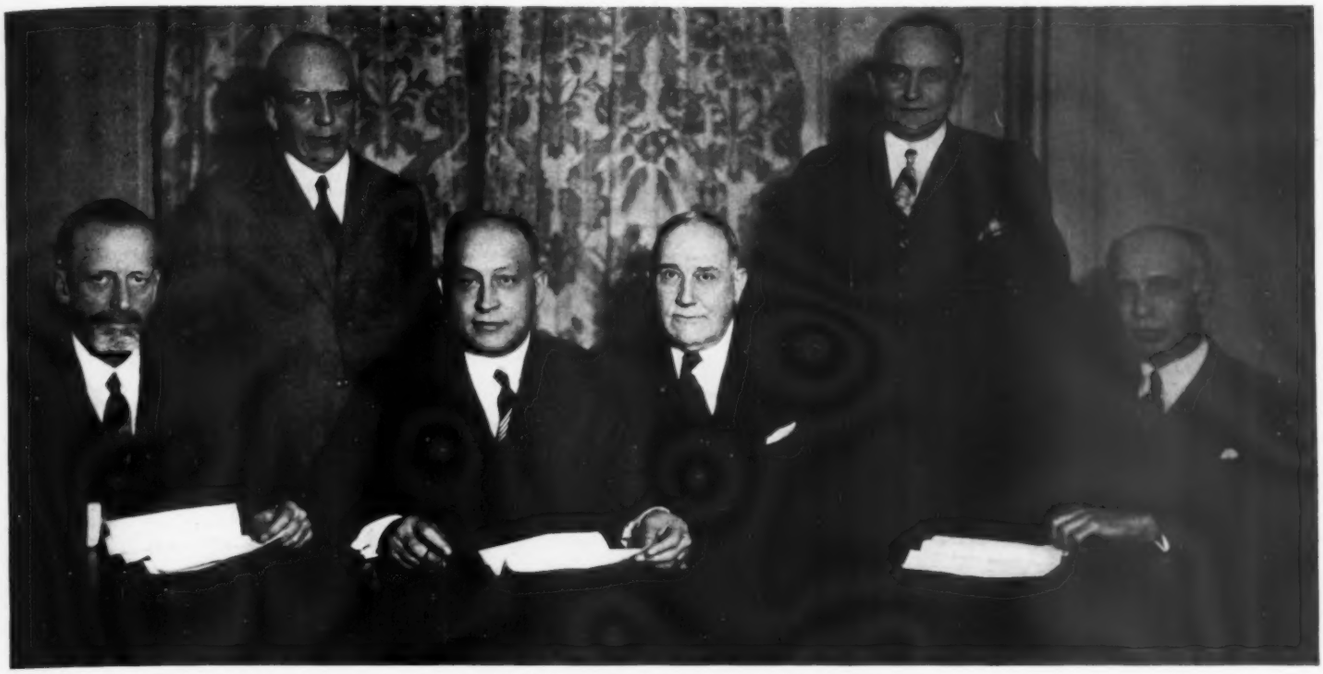


Executives of the American Petroleum Institute meet in 1930: left to right, W. N. Davis, vice president for production; W. M. Irish, vice president for refining; E. B. Reeser, president of the Institute; L. P. St. Clair, vice president at large; W. R. Boyd, Jr.; H. M. Dawes, vice president for marketing.

Defense and the Petroleum Committee ceased to exist. A Petroleum Trade Committee was appointed with the same personnel as the Petroleum Committee, except that J. S. Cosden, as president of Western Petroleum Refiners Assn., succeeded Mr. James, and Samuel Messer, of the Emlenton Refining Co., succeeded Mr. Muir. Within a short time this committee was replaced by the National Petroleum War Service Committee, created for the purpose of cooperating with the Fuel Administrator, Dr. Harry A. Garfield. On January 10, 1918 Dr. Garfield appointed Mark L. Requa head of the Petroleum Division of the Fuel Administration. Once more the Committee was enlarged, the new members being M. J. Byrne, president of the Independent Oil Men's Assn.; A. G. Maguire, president of Bartles-Maguire Oil Co.; George W. Crawford, president of The Ohio Fuel Co.; Henry M. Blackmer, president of Midwest Refining Co.; Dr. Van H. Manning, director of the Bureau of Mines; E. W. Clark, vice president of Union Oil Co. of California; W. S. Farish, president of Gulf Coast Oil Producers Assn.; and Frank Haskell, president of the Mid-Continent Oil & Gas Assn. From time to time others were added, and several hundred oil men served on a variety of sub-committees.

Thomas A. O'Donnell, California oil producer, was appointed assistant to Mr. Requa and was placed in charge of production. Numerous regional committees were created and efforts begun first, to solve two fundamental problems of the industry—allocation of casing to essential wells and adequate transportation—with the assurance by Mr. Requa that the industry would be called upon to cooperate with the government in every way, but that governmental control and supervision would be held to a minimum. Both problems were solved within a short time, the railroad embargo against petroleum shipments being lifted on January 31, 1918. At the beginning of 1917 the industry was operating 189,399 wells; it closed 1919 with 380,893 wells producing. By the end of the war also the industry had in operation nearly 270 refineries with a daily capacity of more than 1,175,000 bbl. of crude oil. As an indication of how the industry kept ahead of demand is the report of more than 7,000,000 bbl. of gasoline in storage at the end of 1918.

From the day of its creation on, the National Petroleum War Service Committee members enjoyed few idle moments. The group received the confidence of the President of the United States and of Army and Navy officials, as well as of the official representatives of Great Britain France, and Italy. Through the committee, orders were placed for oil to be shipped to the Allies and details of transportation were handled. The committee was entrusted with the task of fueling and refueling American naval ships ordered to stations in the war zones.

The committee selected oil men to proceed to posts in the United States and Europe to handle petroleum supplies. When a shortage of tankships developed, the committee appealed to the industry for the loan of such vessels and they were made immediately available.

With government approval overseas supplies were allocated to various conveniently-located refineries, and the orders were filled and delivered on time. Increases in producing and refining facilities were encouraged. When additional bulk transportation became necessary, the committee supervised the refitting of cargo and passenger vessels to accommodate oil shipments. The committee made arrangements to obtain the new fuels necessary for satisfactory operation of the newly-designed Liberty aircraft motors.

Under the intelligent guidance of the committee, tankship and railroad tank car routes and shipments were shifted, not only in the United States, but in other parts of the world to meet the needs of the Allies and to assure a continuing flow of oil. Contracts were made by word of mouth. With the coming of the Armistice, the oil stocks of the Allies were at normal levels, all military consuming agencies on sea and land were operating at full schedule, and the petroleum industry generally had met every demand.

Throughout the entire period of war service, the committee and the petroleum industry had been self-governing. The appointment of Mr. Requa as the government director in December 1917, after nine months of purely voluntary and cooperative activity, had caused some fears. These were dispelled quickly. The administrator advised the committee to proceed with its work as planned, then devoted his attention largely to observing the committee function and setting up within the government certain needed statistical, technical, and other divisions.

The many months of cooperative war effort among the executives of the industry was a new experience. Members of the committee discovered a disposition in the minds of all members of the committee that a national organization of oil men should be formed.

The result was the organization and the incorporation under the laws of the District of Columbia of the American Petroleum Institute. Thomas A. O'Donnell, of California, was elected first president, and the late Robert L. Welch was drafted from the management of the Western Petroleum

Second president of the A. P. I., J. Edgar Pew, 1925.

Refiners Association to be the first general secretary and counsel.

The traditions of their World War service, although only briefly established, were uppermost in the minds of the founders of the Institute at the organization meetings. Their ideas and ideals were reflected in the objectives of the association, which are maintained to this day:

"To afford a means of cooperation with the government in all matters of national concern.

"To foster foreign and domestic trade in American petroleum products.

"To promote, in general, the interests of the petroleum industry in all its branches.

"To promote the mutual improvement of its members and the study of the arts and sciences connected with the petroleum industry."

These objectives still are viewed as broad, general ideals which permit the petroleum industry, through the Institute, to enjoy the legitimate advantages of self-help but scrupulously to avoid detailed annoyances and handicaps which might result from interference with the policies or operations of any individual or company. From the first the tradition was established that the Institute should attempt to undertake to deal only with over-all industrial problems, and to avoid in general undertaking any effort whatsoever unless and until the industry itself voiced its need for the Institute's services. From the first also it was established as tradition that the Institute should concern itself in no way whatsoever with the setting or changing of prices at which the industry's products might be sold, and that except in the way of disseminating historical statistics it should take no interest in prices. The same attitude was established toward quantity production or the promotion of the consumption and sale of the industry's products. Aside from the well known legal inhibitions involved, in both cases it was strongly felt that these matters were the direct concern only of individuals and companies of the industry engaged in producing and selling petroleum products, and that the Institute should maintain a complete disinterest and remain completely inactive in and aloof from these fields of endavor.

On the other hand, the Institute always has functioned as a means of cooperation with the government in all matters of national concern. In this field, in fact, its activities have been expanded to include cooperation with representatives of government in some matters of state and local concern. By utilizing the Institute as a means of contact with the industry, government many times is able to achieve its objectives much more satisfactorily and at far less cost to the taxpayers than otherwise would be possible. The appropriate cooperation of the Institute with federal and other government agencies long has been routine. Not infrequently the Institute works with government agencies in special cases and in emergencies affecting the public safety and welfare.

Third president of the A. P. I., W. S. Farish, 1926.

Promotion of the mutual improvement of its members and of the study of the petroleum arts and sciences probably has been the outstanding accomplishment of the Institute from its inception. It should be remembered that the petroleum industry of the United States is comparatively a new industry. Its operations began only about 80 years ago. Since that time it has had to invent, develop, and build its own equipment, devise its own techniques, experiment with and establish its own practices, undertake its own financing, and otherwise function in a field combining business and science in which there were few precedents.

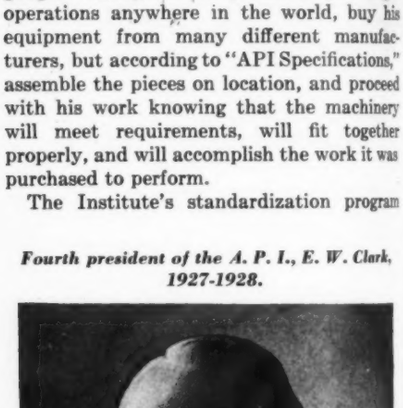
The Institute long has functioned as a technological clearing house for the industry. Its annual and mid-year meetings have been forums at which petroleum engineers, chemists, research workers, technologists, geologists, and others have been able to make known their own findings and to learn of the progress of others. Through the Institute's hundreds of committees—there have been thousands of such committees working since the association was organized—many of the industry's greatest and most handicapping problems have been solved. The Institute was instrumental also in developing the advantages of research, its original cooperative research program having been replaced by the research efforts of many companies which have established their own laboratories.

Instances of Institute helpfulness in these broad fields are too numerous even to catalog. There is the case of standardization of equipment, one of the first problems tackled by the organization. In the old days, there was no standardization. An oil producer, buying equipment from various manufacturers, might encounter extreme difficulty in getting the parts first to fit, and then to function, together. As the industry expanded, these problems became more acute and costly.

The Institute's standardization program was begun. Committees of petroleum engineers sat down with equipment manufacturers to work out some scheme for standardizing the machinery of everyday use. Out of their work has come a system of standardization, the preparation of accepted specifications, the establishment of standard tests and of master gauges. Today an oil producer can begin operations anywhere in the world, buy his equipment from many different manufacturers, but according to "API Specifications," assemble the pieces on location, and proceed with his work knowing that the machinery will meet requirements, will fit together properly, and will accomplish the work it was purchased to perform.

The Institute's standardization program

Fourth president of the A. P. I., E. W. Clark, 1927-1928.



Left, fifth president of the American Petroleum Institute, E. B. Reeser, 1929-1931. Below, first full time president and sixth president of the A. P. I., Amos L. Beaty, 1932.

has made it possible for purchaser and manufacturer to speak the same language and to understand each other perfectly. The program has established minimum and maximum requirements as to physical and chemical properties of equipment and definite grades or qualities of material suitable for use for specific operations. Standardization of basic parts, such as dimensions and threads, has facilitated interchangeability. No longer is it necessary for each purchaser to formulate his own specifications; these are standard throughout the industry, and are entirely practical.

Indirectly, many problems which were costing the industry untold sums in time, annoyance, and loss largely have been eliminated by this activity of the Institute. Not many years ago difficulties with thread on pipe used in large quantities by the industry were major causes of trouble and complaint. The preparation of specifications, the conduct of field and laboratory tests, and the establishment of master gauges have practically eliminated the troubles.

At the present time Institute standing committees are working on standardization of belting, boilers, cable drilling tools, rigs and derricks, tubular goods, rig irons, rotary drilling equipment, wire rope and manila cordage, tanks, and other commonly-used items. "API Standards" have been established, specifications prepared, master gauges made, and manufacturers licensed. The savings to the industry in operating costs alone is estimated at $15,000,000 a year. In fact, savings in operating costs made possible by the Institute's standardization program have contributed greatly to the industry's economy of operation and so to the reduction of the prices at which the industry's products are sold to the public.

A few years ago the industry was troubled by the cost and annoyance of crooked holes in drilling wells. Institute committees were put to work on the problem. Within a few months their completed report indicated the exact nature of the problem, its causes and all the reasons therefor, and a suggested list of preventive measures and cures. As a direct result of their work and by the use of the drilling techniques they evolved and recommended, it is possible today to drill an oil well to thousands of feet in depth with only slight deviation from the vertical. As an indirect result of their work, it is possible to drill an oil well and so to slant or direct it that it may tap oil pools lying beneath irremovable surface obstructions. In other words, the work of these committees contributed not only to the solution of the crooked-hole problem, but led to the development of a new technique, directional drilling.

Ever since the start of pipeline transportation, some 60 years ago, the industry has been troubled by the corrosion of its pipelines. Various remedies have been applied, many without enduring success. Many efforts have been made to prevent corrosion and pitting, the prolific cause of leaks, waste, and loss. For more than 10 years Institute committees have been studying the problem, in field and laboratory, by practice and by theory. During the past few months pieces of typical pipe buried 10 years ago have been excavated, photographed, and studied. At the Institute's 21st annual meeting a progress report on this research project will be made, and the petroleum industry, through the medium of Institute effort, will be on its way to the elimination of another costly and annoying problem.

It was comparatively a few years ago that Institute-sponsored research led to the disclosure that the function of natural gas in oil fields is the production of oil. Prior to the completion of the research project the association of natural gas with crude oil in underground reservoirs was regarded as an annoying situation which had to be endured. The research studies revealed that when an oil reservoir is tapped by the drill, the pressure of natural gas tends to lift the oil to the surface. The study further revealed that when this pressure is dissipated, the oil must be pumped to the surface. As a direct result of this work it is now common practice to preserve gas pressures in oil reservoirs and to utilize the gas energy in producing the oil, thereby reducing producing costs and prolonging the producing life of the reservoir. Indirectly the study led to the disclosure that

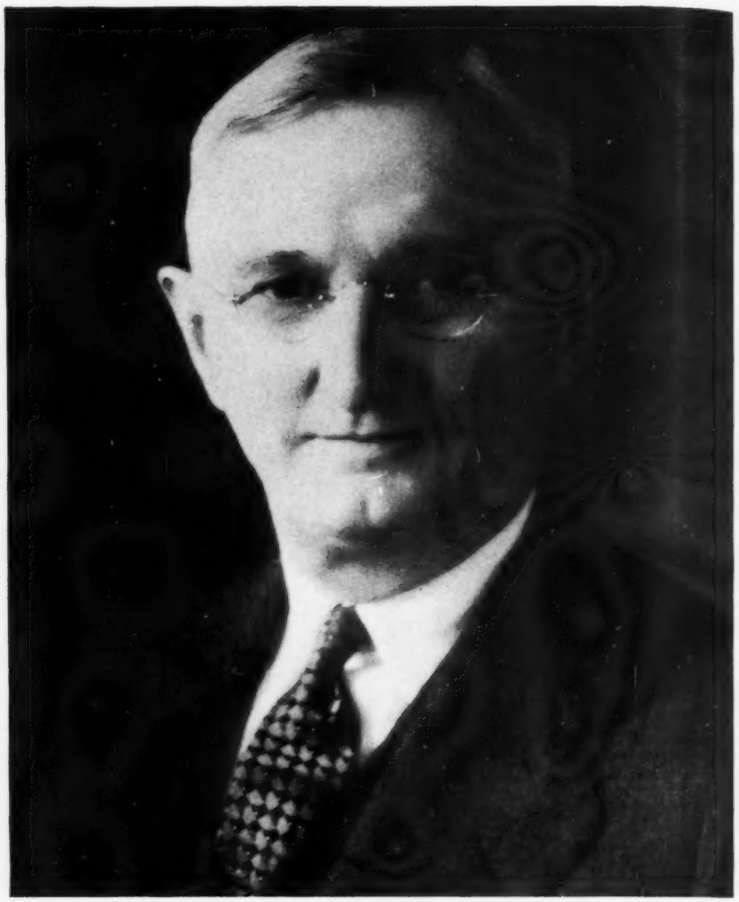
it is possible by repressuring, or injecting gas into the reservoir, both to produce more oil and to recover a vastly greater proportion of the oil than otherwise would be possible.

In its effort to provide the medium whereby the industry's engineers and other scientists may undertake cooperative and collaborative work, the Institute has not overlooked the fact that the petroleum industry fundamentally is comprised of people. The founders of the association themselves recognized this fact, and organized the Institute with and for individual members. To this day the members are individuals, persons rather than companies. Qualifications for membership call for activity in the petroleum and related industries, residence in the United States, Canada, or Mexico, age of 21, or more. There is no initiation fee. Dues of $10 for a calendar year are paid by those who, recommended by the Membership Committee, are elected to membership.

Through the years the physical organization of the Institute has changed with the needs of the industry. Currently the organization consists of the membership body, a Board of Directors comprised of 110 members meeting twice yearly, an Executive Committee of 25 meeting on a monthly basis, a full-time president and executive vice president, three vice presidents, a treasurer, secretary, and assistant secretary.

The membership of the association largely is enrolled in three main groups, the Divisions of Production, of Refining, and of Marketing. The affairs of each division are directed by a General Committee of 25 with an Institute vice president as chairman. Twenty members of each divisional general committee are elected by the members, and five are appointed by the Board of Directors. Members of the Board of Directors are nominated by a Board of Councillors which, in turn is appointed from the membership, and are elected by the members at annual meetings, each for a two-year term. The officers of the Institute are elected by the Board of Directors.

The Institute also has five departments, the Department of Accident Prevention, Department of Engineering, Department of Statistics, Department of Membership and Finance, and Department of Public Relations. Each division and department carries on its work through the medium of a limited number of staff employees and a large number of standing and temporary committees. In the case of the Division of Production there have been organized, in the oil-producing areas, a number of Districts, which hold two meetings a year and a number of Chapters, which meet occasionally. The Chapters are organized in the oilfields and members are field superintendents, engineers, and others interested in or responsible for field operations. The District organizations draw their membership from producing areas. Both Districts and Chapters are interested in and discuss in open meetings field problems and practices, and may make recommendations for Institute activities which, upon approval, become in turn Institute recommendations. Thus, problems arising in any field, or in any producing area, may engage the interest of men from other sections and eventually may be regarded as all-industry problems sufficiently serious to merit national and cooperative study.



Seventh president of the A. P. I., C. B. Ames, first half of 1936.

The Institute organization itself has a number of standing committees, such as the American Petroleum Industries Committee, which is concerned with petroleum taxation and certain phases of legislation, the Committee on Uniform Methods of Accounting, the Committee on Petroleum Reserves, the Committee on Lubrication, and the Advisory Committees on Occurrence and Recovery of Petroleum and Composition and Properties of Petroleum.

Membership on these committees is both voluntary and by invitation. The work of the committees is largely correlative and cooperative. Each committee makes recommendations to the Institute and to the industry, but neither the committee nor the Institute assumes any authority to compel their acceptance or observance. In fact, it is basically the work of the Institute to provide information for the industry, and to make recommendations, but no provision ever has been made in the Institute's charter or by-laws, nor has the Institute ever sought, directly or indirectly, to force the industry, or any branch or unit in particular, either to accept or to abide by its findings or decisions.

This attitude of the Institute toward acceptance of its recommendations is both democratic and practical. Neither the Institute nor its officers and members ever have sought to establish themselves as authorities within the industry, nor to impose their will upon the industry. From the first the Institute has been viewed as exactly what its founders desired that it should be—a clearing house for petroleum information and a forum for oil men.

As a result, Institute membership has attracted men from every branch and phase of the industry, and has become truly representative of the industry. Oil men who call themselves independent are members of Institute committees, the Board of Directors and of the Executive Committee. Similar positions of responsibility and activity are held by executives of large corporations and of small companies, by partners and by individuals.

As further evidence of its thoroughly democratic tendencies has been the policy of the Institute in making its findings and the results of its work available to the entire industry. Every one of its publications is available to anyone in the industry. Its meetings are open to all oil men and to the general public. Its proceedings are published widely in the trade and general press. The Institute's mid-year and annual meetings, while held primarily for oil men, also are open to the general public and the proceedings widely are reported. The Institute's work has always been done in a glass house.

Petroleum Industry's WARTIME SERVICE

By James A. Moffett

American Oil Men Responded to the Call of the Nation a Quarter Century Ago and Met Unprecedented Demands Through Their Own Initiative.

ORGANIZATION of the American Petroleum Institute was the logical outgrowth of the remarkably efficient work done by American oil men in meeting the petroleum needs of the United States and the Allies in the first world war. The story of that task and of its successful accomplishment is one of the many bright chapters in the record of American industrial achievement and is worth recounting briefly inasmuch as it furnished both the initiative for the formation of a permanent association and the inspiration for its later record of useful accomplishment.

Prior to the entry of the United States into the European conflict that began twenty-six years ago the American oil industry had no national association. In retrospect this seems a bit surprising because the industry even then held a place of high commercial importance with an annual production of 300,000,000 bbl., an export trade extending to all parts of the world and an investment running into hundreds of millions of dollars. Probably the explanation is to be found in the fact that the industry was made up of individualists, men who were accustomed to rely on their own judgment and to steer their own course. Their one problem for a number of years had been to find, produce and process enough oil to supply the swiftly expanding demand for products that had come with the development of the motor age.

In 1914, when Europe was suddenly plunged into a struggle for which little preparation had been made, at least by those ranged on one side, an insistent demand for petroleum products set in and the chief impact of this demand fell on the American market. At that time the mechanization of warfare which has been carried to such lengths today was only beginning. The airplane was too new to figure importantly in the plans of military leaders. Many naval vessels still burned coal under their boilers. The use of tanks as a weapon of offense was an untried experiment. Oil was recognized as a vital necessity, however, and by the time the war ended it was credited with a decisive part in determining the outcome.

During the two and a half years that preceded the entry of the United States into the war the British, French and Italians were eager purchasers of American oil. As this buying was done at first through separate agencies and often a single order would be placed in the hands of half a dozen brokers great confusion resulted and serious delays attended the placing of orders. Premiums up to 75 or 100 percent were being paid for certain mid-continent crudes and for gasoline from these crudes which was regarded as suitable for aviation fuel.

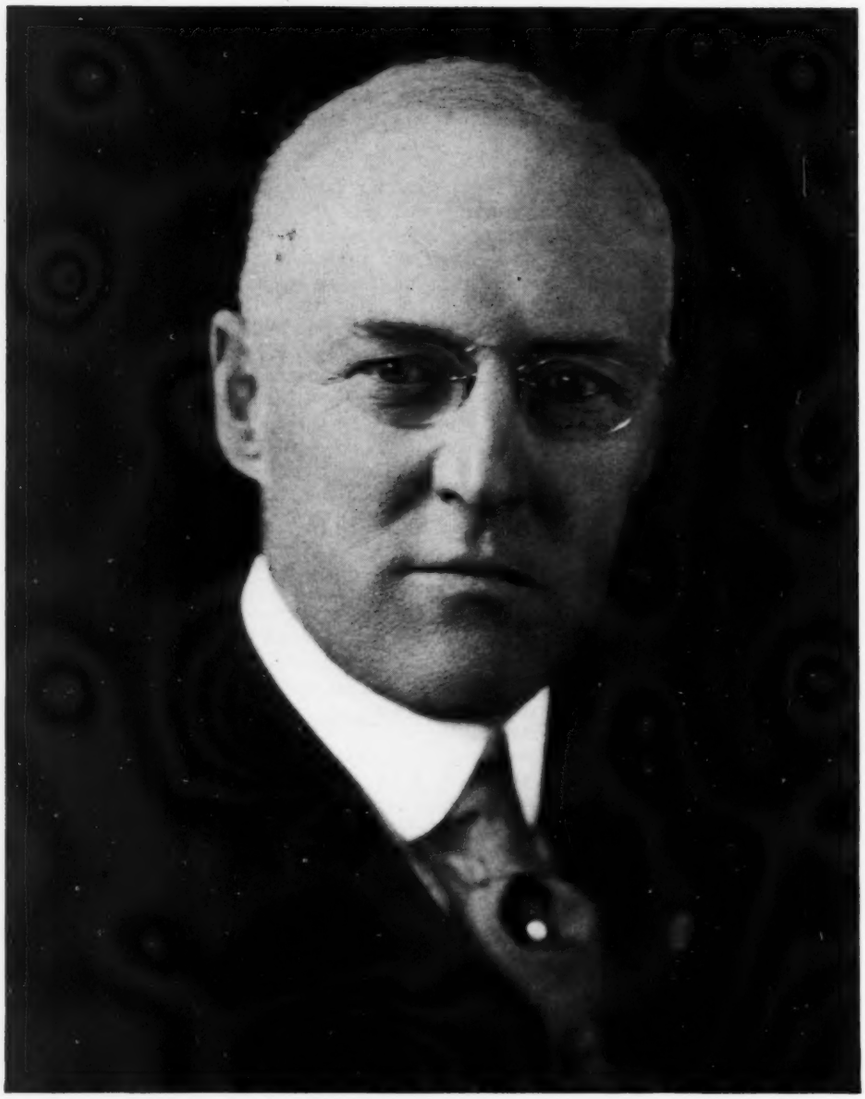
By the latter part of 1916, when the Allies had awakened to the necessity of coordinating their purchases the British representatives appealed to A. C. Bedford of the Standard Oil Company of New Jersey for cooperation from the oil industry in providing supplies and making deliveries. Mr. Bedford assigned me to the task. For several months I handled the principal purchases of the allies, instituting an orderly system for spreading purchases and coordinating them with transportation facilities in such a way as to avoid congestion and delay. This was the first step toward the introduction of systematic methods for meeting the war needs of the allied nations in the matter of petroleum.

When participation in the war by the United States became imminent Mr. Bedford was called into conference by the War Industries Board. As a result of that conference he asked me to proceed to Washington to consult with officials of the Army, Navy and Shipping Board regarding the provision of supplies for immediate needs. My recommendation was that the entire task of handling petroleum requirements be consolidated into one operation. My previous experience in making purchases for the Allies convinced me that if the Army, Navy and other departments were to attempt separately to cover their individual needs the machine would break down for lack of adequate transportation facilities. This recommendation was adopted and proved to be a principal factor in enabling the oil industry to satisfy the full war requirements of the United States and its allies.

At the same time Mr. Bedford was requested to form a National Petroleum War Service Committee. This he did and the members of the original committee were A. C. Bedford, Chairman, J. W. Van Dyke, Atlantic Refining Co., George Davidson, Gulf Oil Corporation, E. C. Lufkin, The Texas Corporation, Edward L. Doheny, California Petroleum Co., and James A. Moffett, Standard Oil Company of New Jersey, secretary. This committee was shortly enlarged to include executives of all the oil companies in a position to assist in the provision of supplies. Operating subcommittees were appointed in Texas and California. By April 1918 the committee had reached its maximum size with a membership of thirty-five. Of these, twenty-three represented independent companies and regional associations and only twelve were identified with the so-called major company group.

The day war was declared, I was requested to come to Washington and report to Assistant Secretary of the Navy Roosevelt. He handed me the sailing order on the first forty-two destroyers which were to proceed to Irish and other ports for submarine patrol. He asked us to arrange to fuel these vessels. Some were able to take sufficient supplies to cross, others had to be fueled at Halifax to make the crossing, and still others had to be

James A. Moffett, secretary of the National Petroleum War Service Committee.



Above, A. C. Bedford, chairman of the National Petroleum War Service Committee, 1917-1918: Left, R. L. Welch, member of the Committee and first general secretary of the A. P. I.

fueled at sea. I returned to New York, reported to the Committee and arrangements were made accordingly.

Things from then on moved very fast. The entire requirements of the Allies and the U. S. forces were pooled for overseas shipment. At the same time, due to submarine losses, it was found that there was not sufficient tanker tonnage.

Mr. Bedford made an appeal to the Committee and a voluntary contribution of several tankers was made by Mr. E. L. Doheny, the Gulf Corporation, Mr. H. F. Sinclair, Texas, Standard of New Jersey and others at a rate of 100 shillings per ton as compared with the current rate of 300 shillings.

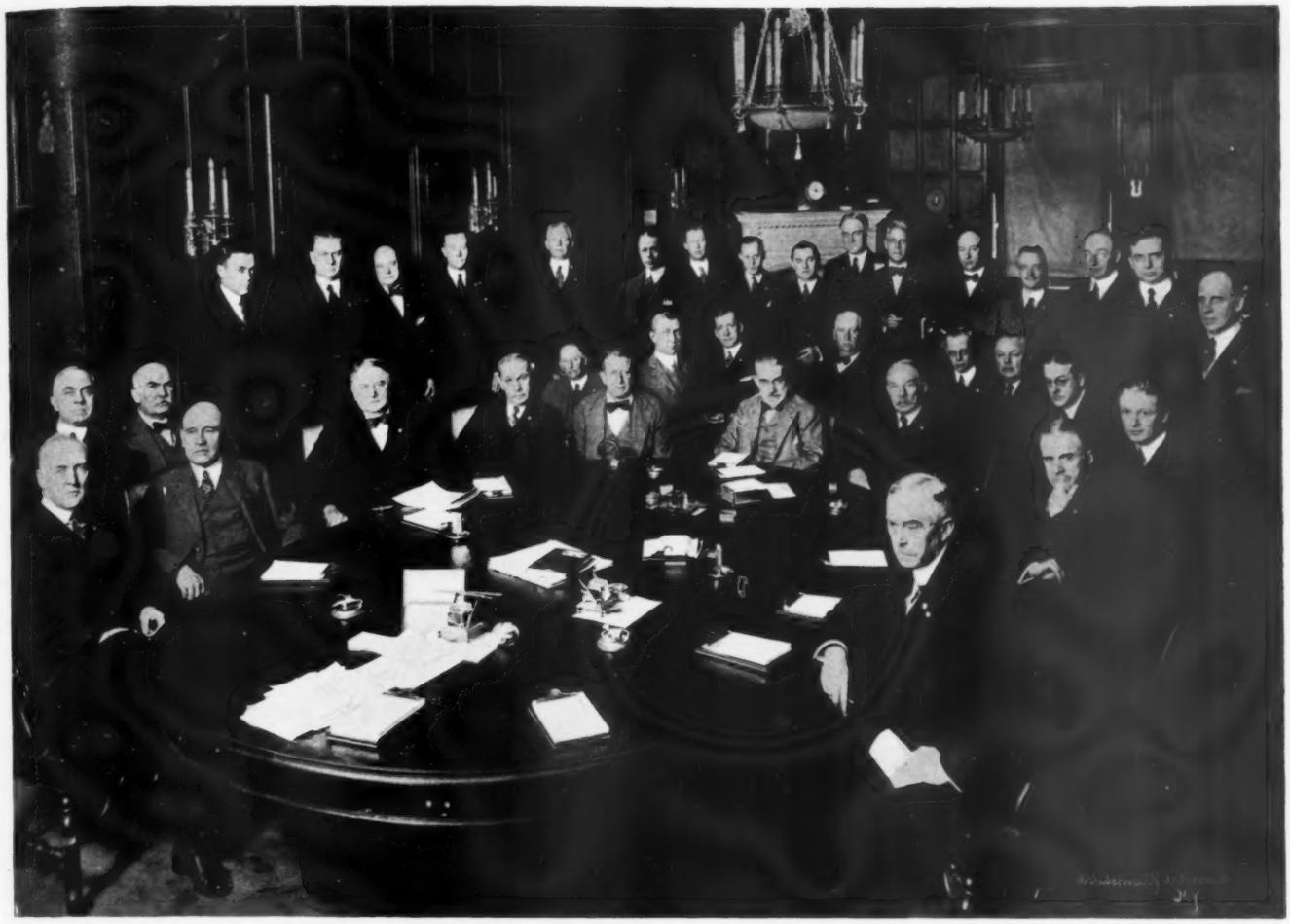
The next step required that the overseas supplies be allocated to the various refineries on the Gulf and Atlantic seaboard. The character of crude and the daily capacity were used to determine the monthly amount of gasoline, kerosene, Diesel oil and fuel oil that each refinery would be called on to supply for overseas shipment, it being understood that in the event of submarine losses making it impossible to lift the requirement during that month, that the quantity would be held over in reserve to be lifted the following month and could not be used for domestic requirements unless released by the Committee. This plan was worked out to apply to every refinery in the United States, but fortunately, was not needed except insofar as it applied to the seaboard refineries.

Almost overnight the domestic requirements jumped by leaps and bounds, due to the war activity, manufacture of munitions, test runs of ships, destroyers, training of firemen for naval vessels and other causes. Immediately the question of available supplies and manufacturing facilities came into the picture. A survey showed that the daily average production in the United States was 1,100,000 bbl. per day and the refinery capacity was estimated at 1,800,000 bbl. per day. Projecting the increasing overseas demands with the operation of the U. S. forces, with the increasing domestic demand, it was clear that the maximum effort would have to be made to obtain production.

In June, information was received to the effect that the normal minimum stock of fuel oil of the British Admiralty of one million tons had dropped to 570,000 tons, that the British fleet had partially demobilized and that the destroyers on submarine patrol had reduced their speed of patrol from 26 knots to about 18 knots to conserve fuel and that automatically the submarine losses had materially increased and it was essential to concentrate on fuel oil supplies to the British Admiralty even to the extent of eliminating necessary shipments of motor gasoline and aviation spirit to the Allied land force.

Additional bulk transportation had to be found. Immediate steps were taken to fit out every cargo and passenger vessel to carry oil in the double bottoms or ballast tanks and every cargo and passenger boat which loaded at any port from Galveston to Montreal carried some oil in this manner, unless they were carrying a deadweight cargo of wheat or munitions which prohibited any further cargo. The question of loading double bottoms and ballast tanks created a new problem for the industry. We shipped trainloads of fuel oil from Oklahoma to Montreal; we shipped trainloads of fuel oil from Wyoming to Philadelphia and to the U. S. Gulf. All the time the demand was increasing. Supplies were being brought in from Mexico and then it became apparent that a conservation effort had to be made and the next thing was the gasoline-less Sunday. The estimated requirements of aviation gasoline were staggering to the industry at that time but all essential demands were met through the united efforts of the industry.

Throughout this period the American petroleum industry was a self-governing industry and its war effort was a self-operated effort. Everything was done volun-



National Petroleum War Service Committee, forerunner of the American Petroleum Institute, meeting in 1918. Left to right seated: A. C. Bedford, E. C. Lufkin, Judge Carey, Mark Requa, J. W. Van Dyke, George W. Davison, Edward Priza, Thomas O'Donnell, Ivy Lee, Samuel Messer, H. L. Doherty, Commodore O'Donnell, E. W. Clark, R. D. Benson (right foreground), A. C. Maguire, W. P. Cowan, H. M. Blackmer, H. E. Felton, and J. S. Cosden.

Standing, left to right: W. C. Teagle, James O'Neill, H. F. Sinclair, John Markham, George Crawford, J. Howard Pew, (Unidentified), J. A. Moffett, Joseph Guffey, (Unidentified), (Unidentified), W. S. Farish, (Unidentified), (Unidentified), R. L. Welch, and A. P. Coombe.

tarily. In December 1917, the government appointed Mark L. Requa, director of the Petroleum Division of the United States Fuel Administration. He set up statistical, technical and other divisions in his organization in Washington, but he continued to allow the National War Service Committee to function as it had in the previous nine months and his effort was to help from a government standpoint rather than to dictate or interfere in the operation.

Mr. Requa appointed A. C. Woodman and myself a committee of two, called the Committee of Allocation of the United States Fuel Administration, to see that credits were properly approved by the Treasury Department, and that we had commandeering power if necessary to secure adequate supplies for overseas. At no time was this necessary; the industry always met the allocation of orders on the dot. The petroleum industry, unlike other industries, did not demand forward transactions or huge purchase made in advance. It was a day to day business.

When the Armistice occurred the Allies and the United States, for overseas shipment, were obligated for less than $100,000 worth of products. At the same time the British Admiralty's stock had been built up to the normal level at that time of one million tons, the fleet had been in a position to maintain its proper speed of patrol, the Army had sufficient supplies to serve its objective; or, in other words, the industry had met every call.

This experience in working together in the accomplishment of a task of national importance undoubtedly turned the thoughts of many members of the industry to the desirability of maintaining the machinery for such cooperative activity. When or by whom the suggestion for a permanent national organization was first made is not definitely established, but unquestionably A. C. Bedford was primarily the creator of the American Petroleum Institute, with E. C. Lufkin of the Texas Corporation through the remarkable work of the war service committee under his leadership.

In the period immediately following the conclusion of the committees war work the subject was widely discussed. At the post-war convention of the United States Chamber of Commerce, held in Atlantic City early in December 1918 a group session of oil men, including members of the National Petroleum War Service Committee and others adopted a resolution calling for a meeting of the committee to formulate and effect a permanent and comprehensive organization of the petroleum industry.

It was a tribute to the efficiency with which the Petroleum War Service Committee had carried on its difficult tasks during the world war that its thirty-five members were designated to serve as the first board of directors of the American Petroleum Institute which was a direct outgrowth of its wartime activities. Thus its members have the satisfaction of feeling that they were enabled to make a worthwhile contribution to the nation's welfare both by meeting its wartime demand for products of vital importance and by laying the foundation for the great organization of the oil industry which has done so much for technical progress and for preparing the industry to play a great part once more in the patriotic work of national defense. In both instances success was made possible only by whole hearted cooperation and support from the great body of members of the oil fraternity.

PROGRAM

Twenty-first Annual Meeting

AMERICAN PETROLEUM INSTITUTE

Registration and Information Desk—
Foyer—Grand Ball Room

Production Division Headquarters . . . Room 421-A

Press Headquarters . . . . . Room 557

Stevens Hotel

Chicago, Ill.

November 11 to 15, 1940

BOARD OF DIRECTORS MEETINGS

Private Dining Room No. 1

Tuesday, November 12, 1940.....2:30 PM

Wednesday, November 13, 1940.....10:00 AM
(Luncheon at Noon)

Thursday, November 14, 1940.....10:00 AM

Executive Committee

The newly-elected Executive Committee will meet immediately following the last session of the Board of Directors.

BOARD OF COUNCILLORS MEETING

North Ball Room

Wednesday, November 13, 1940.....10:00 AM

To nominate Candidates for Election as Members of the Board of Directors.

ANNUAL DINNER

Grand Ball Room

Thursday, November 14, 1940.....7:30 PM

A Program of Entertainment

GENERAL SESSION

Grand Ball Room

Wednesday, November 13, 1940

2:00 PM

General Session:

Presentation of Accident-Prevention Certificate Awards.

Report of Board of Councillors and Election of Directors.

President's Address:

Axtell J. Byles, American Petroleum Institute, New York, N. Y.

Address:

T. H. Barton, Lion Oil Refining Co., El Dorado, Ark.

Address:

Dr. Robert E. Wilson, in charge of Petroleum Section, Raw Materials Division, Advisory Commission to the Council of National Defense, Washington, D. C.

Thursday, November 14, 1940

2:00 PM

General Session:

Address:

W. J. Cameron, Ford Motor Co., Detroit, Mich.

Address:

H. W. Prentis, Jr., National Association of Manufacturers, New York, N. Y.

Address:

Hon. Martin Dies, Member of Congress, Washington, D. C.

GROUP SESSIONS — AUTOMOTIVE TRANSPORTATION

Tuesday, November 12, 1940

2:00 PM (South Ball Room)

Protection Against Static Electricity.
J. M. Pearson, Sun Oil Co., Philadelphia, Pa.

Preventing and Extinguishing Tank-Truck Fires.
J. F. Winchester, Standard Oil Co. of New Jersey, New York, N. Y.

Should Gross-Weight Limitations Be Universal?
J. W. Sinclair, Union Oil Co. of California, Los Angeles, Calif.

Safe Transportation in Oil Fields.
R. B. Roaper, Humble Oil and Refining Co., Houston, Texas.

GROUP SESSIONS — DIVISION OF PRODUCTION

Wednesday, November 13, 1940

9:30 AM (South Ball Room)

Oil Recovery by Air Drive in the Venango Fields of Pennsylvania.
P. A. Dickey, Pennsylvania Topographic and Geologic Survey, Harrisburg, Pa., and R. B. Bossler, Brundred Oil Corp., Oil City, Pa.

Factors Affecting Reservoir Performance.
R. D. Wyckoff, Gulf Research and Development Co., Pittsburgh, Pa.

The Determination of Factors Affecting Reservoir Performance.
M. Muskat, Gulf Research and Development Co., Pittsburgh, Pa.

Multiple Liquid Phases in Hydrocarbon Solutions.
W. N. Lacey, California Institute of Technology, Pasadena, Calif.

Thursday, November 14, 1940

9:30 AM (West Ball Room)

API Pipe-Coating Tests—Final Report.
Kirk H. Logan, National Bureau of Standards, Washington, D. C.

Fluid-Meter Research at the University of Oklahoma.
W. H. Carson, Dean, College of Engineering, The University of Oklahoma, Norman, Okla.; and E. E. Ambrosius, Associate Professor of Mechanical Engineering, The University of Oklahoma, Norman, Okla.

Thirty-Minute Movie—"Construction of Salt Lake City Pipe Line of Stanolind Pipe Line Company."
J. C. Stirling, Stanolind Pipe Line Co., Tulsa, Okla.

9:30 AM (South Ball Room)

Hydraulics of Mud-Circulating Systems.
W. W. Moore, Tulsa, Okla.

Continuous Logging at Rotary-Drilling Wells.
J. T. Hayward, Barnsdall Research Corp., Tulsa, Okla.

Economics of Controlling Water Produced with Oil.
J. U. Teague, Hogg Oil Co., Houston, Texas.

Report of Division's Nominating Committee.
A. H. Riney, Phillips Petroleum Co., Bartlesville, Okla., Chairman.

Election of Twenty Members of the General Committee of the Division of Production.

Wednesday, November 13, 1940

9:30 AM **(Grand Ball Room)**

Miscellaneous Topics:

Presiding: G. W. Hanneken, The Standard Oil Co. (Ohio), Cleveland, O.

Use of Lecithin in Gasoline.
H. V. Rees, W. S. Quimby, and J. C. D. Oosterhout, The Texas Co., New York, N. Y.

The Naphtha Polyform and Gas Reversion Processes.
J. E. Bogk, Phillips Petroleum Co., Bartlesville, Okla.; P. Ostergaard, Gulf Oil Corp., Pittsburgh, Pa.; and E. R. Smoley, The Lummus Co., New York, N. Y.

Synthetic Chemicals from Petroleum.
L. Rosenstein, Shell Chemical Co., San Francisco, Calif.

Use of Azeotropic Distillation in Separating Hydrocarbons from Petroleum.
Frederick D. Rossini, B. J. Mair, and A. R. Glasgow, Jr., National Bureau of Standards, Washington, D. C.

The Emulsion De-oiling Process.
A. H. Schutte, The Lummus Co., New York, N. Y.

Thursday, November 14, 1940

9:30 AM **(Grand Ball Room)**

Classification of Motor Oils.
W. S. James, The Studebaker Corp., South Bend, Ind.

Heavy-Duty Motor Oils.
H. C. Mougey, General Motors Corp., Detroit, Mich.

Illustrated Field Observations of Paint Performances and Practices at Refineries.
H. H. James, E. L. duPont de Nemours & Co., Tulsa, Okla.

Friday, November 15, 1940

10:00 AM **(Grand Ball Room)**

Engine Performance as Influenced by Ignition-Timing Maintenance.
R. J. Greenshields and L. E. Hebl, Shell Oil Co., Inc., Wood River, Ill.

Fuel-Quality Requirements as Affected by Items of Motor Maintenance.
H. M. Trimble and K. C. Bottenberg, Phillips Petroleum Co., Bartlesville, Okla.

Trends in Automotive Design Match Evolution in Fuels.
T. A. Boyd and W. G. Lovell, General Motors Corp., Detroit, Mich.

Report of Division's Nominating Committee.
H. W. Camp, Cities Service Oil Co., Bartlesville, Okla., Chairman

Election of Twenty Members of the General Committee of the Division of Refining.

COMMITTEE MEETINGS

Friday, November 8

10:00 am **Special Subcommittee on Simplification of Casing Lists.** (Room 445-A)

Saturday, November 9

2:00 pm **Correlating Committee on Gages and Gaging Practice.** (Room 440-A)

8:00 pm **Subcommittee on Thread Measurements.** (Room 450-A)

Monday, November 11

9:00 am **Joint Meetings:** (Room 444-A)
Engineers' Subcommittee on Tanks.
Production-Tank Manufacturers' Subcommittee.

9:00 am **Manufacturers' Subcommittee on Boilers.** (Room 452-A)

9:00 am **Engineers' Subcommittee on Boilers.** (Private Dining Room No. 6)

9:00 am **Subcommittee on Fundamentals of Sampling, Transporting, and Analyzing Sub-surface Samples of Crude Oil (of the Topical Committee on Production Technilogy).** (Room 450-A)

9:00 am **Subcommittee on Core Analysis and Electrical Logging (of the Topical Committee on Production Technology).** (Room 430-A)

9:00 am **Subcommittee on Oil-Well Cements (of the Topical Committee on Materials).** (Room 435-A)

9:00 am **Special Subcommittee on Primary Pressure Control (of the Topical Committee on Production Practice).** (Room 451-A)

9:00 am **Special Study Committee on Well Spacing and Allocation of Production (of the Central Committee on Drilling and production Practice).** (West Ball Room)

9:00 am **Special Subcommittee on Drilling-Contract Form (of the Topical Committee on Drilling Practice).** (Private Dining Room No. 5)

9:00 am **Committee on Disposal of Refinery Wastes.** (Private Dining Room No. 3)

9:00 am **Central Committee on Accident Prevention.** (Private Dining Room No. 1)

10:00 am **Committee on Vocational Training in Refining.** (Private Dining Room No. 9)

10:30 am **Subcommittee on Secondary-Recovery Methods (of the Topical Committee on Production Practice).** (Room 440-A)

2:00 pm **Special Subcommittee on Radiator-Type Cooling Units (of the Subcommittee on Internal-Combustion Engines).** (Room 451-A)

2:00 pm **Topical Committee on Production Technology.** (Room 430-A)

2:00 pm **Topical Committee on Drilling Practice.** (Room 440-A)

2:00 pm **Group 1—Subcommittee on Uniform Tank Measurements and Gage Tables (of the Central Committee on Measuring, Sampling, and Testing Crude Oil).** (Room 435-A)

2:00 pm **Manufacturers' Subcommittee on Steel Derricks and Rig Irons.** (Room 450-A)

2:00 pm **Meeting of Chairmen and Vice Chairmen (of the Committee on Uniform Methods of Oil Accounting).** (Conference Room—Lower Level)

8:00 pm **Committee on Corrosion of Refinery Equipment.** (Private Dining Room No. 3)

8:00 pm **Advisory Committee on Fundamental Research on Composition and Properties of Petroleum.** (Private Dining Room No. 9)

8:00 pm **Subcommittee on Rating of Speed Reducers.** (Room 440-A)

Tuesday, November 12

9:00 am **Committee on the Standardization of Oil-Country Tubular Goods.** (North Assembly Room)

9:00 am **Sucker-Rod Manufacturers' Subcommittee.** (Room 444-A)

9:00 am **Joint Meeting:** (Room 452-A)
Engineers' Subcommittee on Boilers.
Manufacturers' Subcommittee on Boilers.

9:00 am **Subcommittee on Temperature Measurement.** (West Ball Room)

9:00 am **Topical Committee on Pipe-Line Technology (of the Central Committee on Pipe-Line Transportation).** (Room 430-A)

9:00 am **Conference Subcommittee on Accounting Regulations (of the Central Committee on Pipe-Line Transportation).** (Room 435-A)

9:00 am **Topical Committee on Production Practice.** (Room 440-A)

9:00 am **Group 1—Subcommittee on Measuring, Sampling, and Testing Natural Gasoline.** (Room 451-A)

9:00 am **Committee on Disposal of Refinery Wastes.** (Private Dining Room No. 3)

9:00 am **Committee on Fire Prevention in Refineries.** (Private Dining Room No. 5)

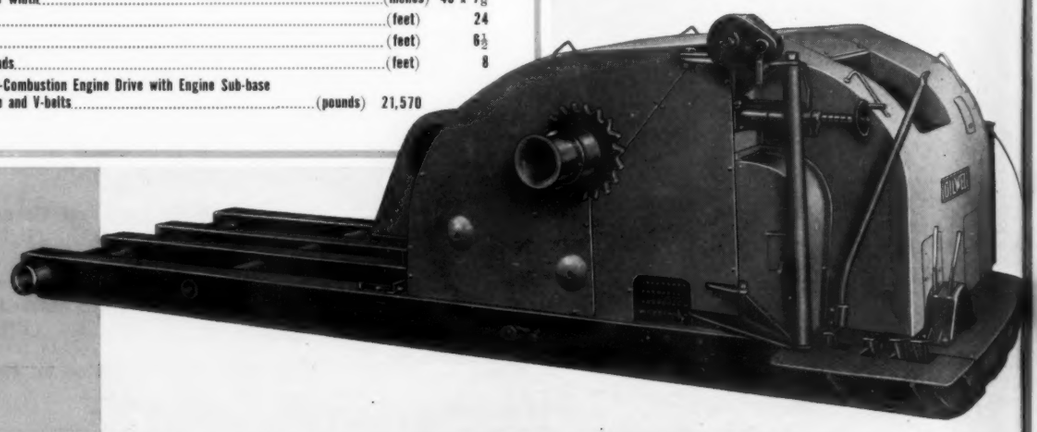
9:00 am **Program Committee, Division of Refining.** (Private Dining Room No. 8)

NEW "OILWELL" FOR FASTER, SAFER,

"OILWELL" NO. 64 UNIVERSAL HOISTING UNIT

. . . a compact and portable four-speed hoist of unitized construction, providing ease of operation combined with utmost efficiency and dependability.

Recommended Max. Drilling Depth with $4\frac{1}{2}''$ Drill Pipe	(feet)	5,000
Drum: Spool Diameter	(inches)	16
Width between Flanges	(inches)	$26\frac{1}{2}$
Brake Rims, Diameter by Face Width	(inches)	48 x $7\frac{5}{8}$
Length, Over-all	(feet)	24
Height, Over-all	(feet)	$6\frac{1}{2}$
Width, Over-all without Catheads	(feet)	8
Weight, Complete for Internal-Combustion Engine Drive with Engine Sub-base but less Engine and V-belts	(pounds)	21,570



"OILWELL" NO. CT-1715 ROTARY DRILLING UNIT

. . . an internal-combustion engine, direct-connected rotary drive with hydraulic torque converter, providing the smooth and flexible power-flow of a steam-driven rotary drilling unit. The drive responds through simply changing the engine throttle setting, which is regulated by a convenient remote control at the driller's position. There are no other controls and no clutches.

Speed Ratios:	"Oilwell" $17\frac{1}{2}$-inch Oilbath Rotary	3.93 : 1
	Gear Box (Speed Increaser)	1 : 1.44
Weight:	Complete with 138 horsepower Engine	14,900 lbs.
	Complete with 193 horsepower Engine	16,500 lbs.

The swift advancement of your drilling program requires Modern Equipment

ROTARY EQUIPMENT
MORE ECONOMICAL DRILLING

"OILWELL" SUPER SWIVEL

. . . designed for the requirements of tomorrow, providing an extra factor of safety for the highest speeds and greatest depths of today.

Dead-load Capacity	(tons)	400
Maximum Recommended Drilling Depths		
with 4½"-18 # Drill Pipe: 100 r.p.m.	(feet)	17,000
200 r.p.m.	(feet)	14,000
400 r.p.m.	(feet)	11,000
Fully Streamlined Fluid Passage, Diameter	(inches)	4
Body, A.P.I. Left-hand Tool-joint Threads	(inches)	7⅝
Wash Pipe, faced Inside and Outside		DI-HARD
Weight, Complete less Hose Connection	(pounds)	4,800

"OILWELL" 21-INCH SUPER-SPEED ROTARY

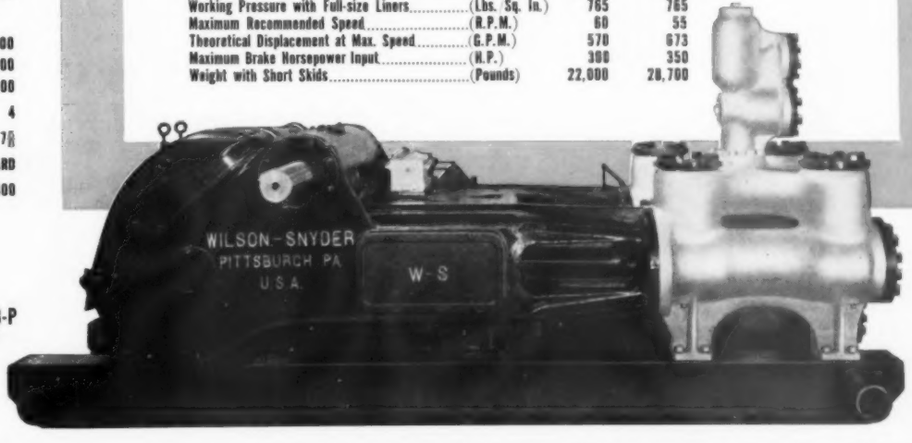
. . . designed, constructed and tested for 1,000 r.p.m. operation. Fully heat-treated, spiral-bevel gearing with surface-hardened pinion. Self-centering, angle-contact main bearing with high-precision balls of large diameter and surface-hardened, heat-treated and ground, alloy-steel races. Positive forced-feed and circulating-oilbath lubrication.

Rated Supportable Dead-load Capacity	(tons)	300
Maximum Recommended Drilling Depth	(feet)	17,000
Gear Ratio		2.61 : 1
Weight, Complete less Drive Bushing	(pounds)	9,624

"OILWELL" NO. 14P-HD AND WILSON-SNYDER NO. 18-P POWER SLUSH PUMPS

. . . sturdier power pumps for the more severe drilling requirements. Both pumps are built for efficient and reliable performance over a wide range of operating conditions.

		No. 14P-HD	No. 18-P
Maximum Liner Size by Stroke	(Inches)	7½" x 14"	7½ x 18"
Hydraulic Test Pressure, Discharge	(Lbs./Sq. In.)	4,000	4,000
Maximum Working Pressure	(Lbs./Sq. In.)	2,500	2,500
Working Pressure with Full-size Liners	(Lbs./Sq. In.)	765	765
Maximum Recommended Speed	(R.P.M.)	60	55
Theoretical Displacement at Max. Speed	(G.P.M.)	570	673
Maximum Brake Horsepower Input	(H.P.)	300	350
Weight with Short Skids	(Pounds)	22,000	28,700



WILSON-SNYDER NO. 18-P
POWER SLUSH PUMP

OIL WELL SUPPLY COMPANY

EXECUTIVE OFFICE—DALLAS, TEXAS
EXPORT DIVISION OFFICE—
30 ROCKEFELLER PLAZA, NEW YORK CITY

Branch Stores in all Oil Fields
United States Steel Corporation Subsidiary

DIVISION OFFICES—
OIL CITY, PENNA. DALLAS, TEXAS
LOS ANGELES, CALIF.

COMMITTEE MEETINGS

Tuesday, November 12

9:00 am **Committee of Refinery-Inspection Supervisors.** (Private Dining Room No. 11)

10:00 am **Subcommittee on Car Service.** (Private Dining Room No. 6)

10:00 am **Committee on Uniform Methods of Oil Accounting.** (Conference Room—Lower Level)

10:00 am **American Petroleum Industries Committee.** (Private Dining Room No. 10)

10:00 am **Lubrication Committee.** (Private Dining Room No. 9)

11:00 am **Committee on Testing Methods and Specifications.** (West Ball Room)

12:15 pm **Correlating Committee on Measuring, Sampling, and Testing Crude Oil (Luncheon).** (Private Dining Room No. 4)

1:30 pm **Committee on Hydrocarbon Research.** (Council Room—Lower Level)

2:00 pm **Topical Committee on Materials.** (Room 440-A)

2:00 pm **Advisory Committee on Fundamental Research on Occurrence and Recovery of Petroleum.** (Room 445-A)

2:00 pm **Special Subcommittee on 7,500-Lb Valves (of the Group 2 Subcommittee on Production Valves).** (Room 450-A)

2:00 pm **Subcommittee on Internal-Combustion Engines.** (Room 450-A)

2:00 pm **Committee on Railroad Transportation.** (West Ball Room)

2:00 pm **Committee on Standardization of Refinery Equipment.** (Private Dining Room No. 8)

6:00 pm **Central Committee on the Standardization of Oil-Field Equipment (Dinner).** (Private Dining Room No. 4)

8:00 pm **Central Committee on Refinery Technology.** (South Ball Room)

8:00 pm **Group 2—Subcommittee on Production Valves (of the Subcommittee on Valves and Fittings).** (Room 450-A)

Wednesday, November 13

9:00 am **Main Subcommittee on Valves and Fittings.** (Room 450-A)

9:00 am **Central Committee on Pipe-Line Transportation.** (Room 430-A)

9:00 am **Group 2—Subcommittee on Measuring, Sampling, and Testing Natural Gas.** (Room 445-A)

9:00 am **Valve-Cup Manufacturers (Informal)** (Room 435-A)

9:00 am **Committee on Disposal of Refinery Wastes.** (Private Dining Room No. 3)

10:00 am **Central Committee on Automotive Transportation.** (West Ball Room)

10:00 am **Committee on Uniform Methods of Oil Accounting.** (Conference Room—Lower Level)

12:15 pm **Executive Committee (of the Central Committee on Drilling and Production Practice) (Luncheon).** (Private Dining Room No. 4)

12:15 pm **Committee on Motor Fuels (Luncheon).** (Private Dining Room No. 9)

4:00 pm **General Committee, Division of Refining.** (West Ball Room)

4:30 pm **Nominating Committee, Division of Production.** (Room 445-A)

6:00 pm **Central Committee on Measuring, Sampling, and Testing Natural Gas and Natural Gasoline (Dinner).** (Private Dining Room No. 4)

Thursday, November 14

9:00 am **Central Committee on District Activities.** (Room 440-A)

10:00 am **Committee on Uniform Methods of Oil Accounting.** (Conference Room—Lower Level)

12:15 pm **General Committee, Division of Production (Luncheon).** (North Assembly Room)

12:15 pm **Joint Meeting:** (Private Dining Room No. 5)
Program and Advisory Committees, Eastern District, Division of Production (Luncheon).

2:30 pm **Program Committee (of the Central Committee on Drilling and Production Practice).** (Room 445-A)

4:00 pm **Special Joint Committee on Storage-Tank Venting.** (Private Dining Room No. 3)

4:30 pm **Nominating Committee, Division of Refining.** (North Assembly Room)

Other Committee Meetings

The following committees will meet at the time and place indicated to its members by the chairman.

Engineers' Subcommittee on Pipe.
Pipe-Manufacturers' Subcommittee.
Joint Meeting:

Engineers' Subcommittee on Pipe.

Pipe-Manufacturers' Subcommittee.

API-AWS Conference Committee on Tank Welding.

Engineers' Subcommittee on Tanks.

Program Committee (of the Central Committee on Drilling and Production Practice).

Subcommittees on Standard Field Procedure for Testing Drilling Fluids (of the Topical Committee on Drilling Practice).

Synthetic Chemicals from Petroleum

By L. Rosenstein
Shell Chemical Co.,
San Francisco, Calif.

Petroleum As Raw Material for Manufacture of Synthetic Chemicals Has Had a Profound Influence on the Chemical Industry. Oil Industry Affords Stable and Abundant Source of Cheap Raw Material. An A. P. I. Paper Being Delivered at the Annual Meeting on November 13.

Natural gas reformer plant of the Shell Chemical Company where gas containing 70 per cent hydrogen is produced.

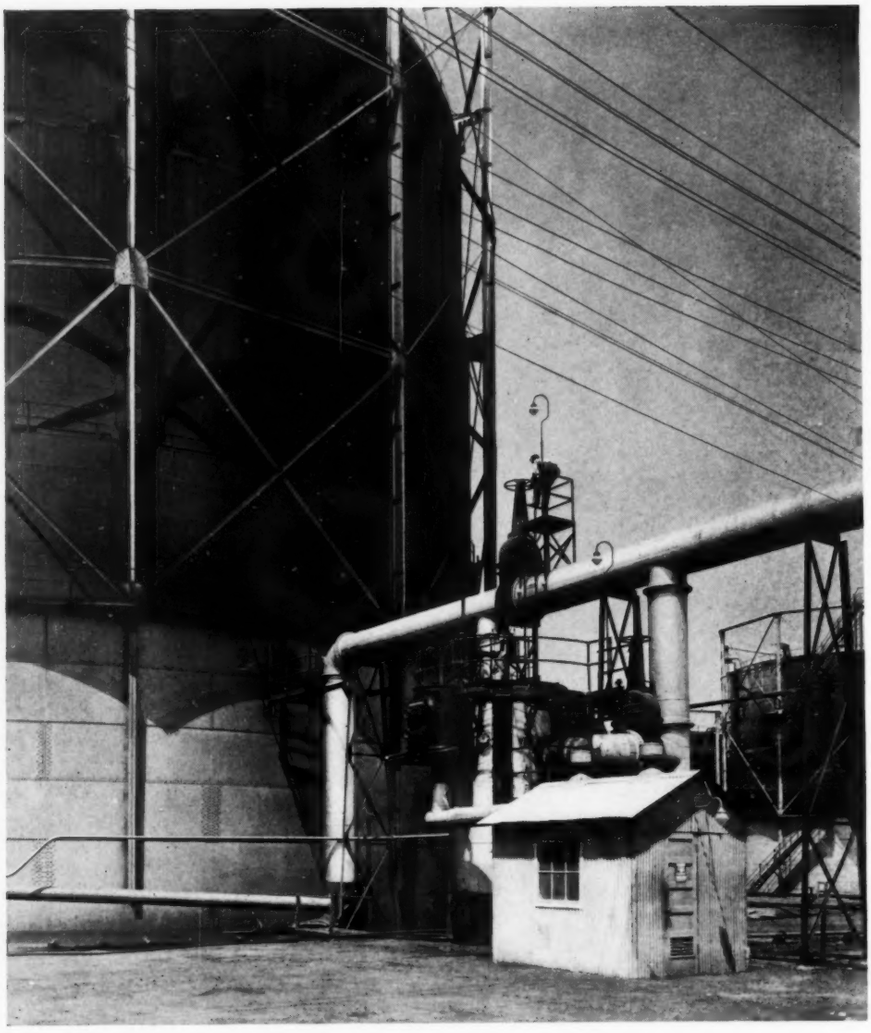
THE manufacture of synthetic chemicals from petroleum and from natural gas, closely related to it, is becoming a major American industry. Petroleum is well suited as a chemical raw material; it is cheap and abundant, and contains a wide variety of chemical types which, in themselves or after cracking to simpler compounds, may be converted to derivatives of many kinds. Several general reviews of this field recently have appeared; the present paper will be concerned largely with developments in which Shell Chemical Company has played some part. These developments are, however, typical of the petroleum chemical industry as a whole.

At the outset a word of explanation may be in order regarding the relation of Shell Chemical Company to its associates, Shell Oil Company, Inc. and Shell Development Company. By and large it may be said that Shell Chemical operates on raw materials which Shell Oil is in a position to furnish; and it uses processes and manufactures products which have been developed in the research laboratories and pilot plants of Shell Development. On behalf of Shell Chemical, the latter carries on extensive market research concurrently with its investigations of processing, to the end that applications may be found and markets developed for present and potential chemical products, and new products may be supplied to meet the expressed needs of industry.

In the synthetic-chemical field Shell Chemical Company has been active both in the synthesis of alcohols, ketones, etc., from refinery cracked gases, and in the manufacture of ammonia and related products from natural gas and atmospheric nitrogen. Commercial operations were begun in 1930 with the production of secondary butyl alcohol from butylene at Martinez, Calif.; and, within a year, the synthesis of ammonia at Shell Point, near Pittsburg, Calif. Expanding operations necessitated extension of the Martinez plant in 1933 to manufacture tertiary butyl alcohol and methyl ethyl ketone, and soon thereafter at the same location a plant was built to regenerate spent alcohol acid to make it usable in manufacturing ammonium sulfate. In 1936 a large alcohol and ketone plant was built at Dominguez, near Los Angeles; and this since has been enlarged to produce acetates and higher-boiling ketones. In the first year of commercial operation about 4,500 tons of ammonia and 90,000 lb. of solvents were produced; in 1939 the corresponding figures were 27,000 tons and 57,000,000 lb. About half of the ammonia produced is converted into ammonium sulfate; and in this connection it may be noted that means have been found to use acid sludge from petroleum refining for this conversion, without impairing the quality of the ammonium sulfate produced

The manufacture of ammonia at Shell Point begins with the cracking of natural gas over a brick checkerwork, at an average temperature of 1,100 deg. C, yielding a gas containing 70 percent of hydrogen, the rest being unconverted methane, with small amounts of nitrous oxide, carbon monoxide, carbon dioxide, benzene, ethylene, acetylene, and naphthalene. Most of the carbon content of the natural gas is converted to the solid form; it is separated from the crude hydrogen by washing with water and by electrical precipitation. Nitrous oxide is removed from the hydrogen by passage over iron oxide; naphthalene and benzene by washing with oil; carbon dioxide by washing with water and alkali; and light hydrocarbon impurities (methane, ethylene, and acetylene) by low-temperature fractionation, in the last stage of which liquefied atmospheric nitrogen is introduced to aid in the removal of carbon monoxide by fractionation, and to form a nitrogen-hydrogen mixture in the molecular proportions of ammonia. In the synthesis plant the last traces of carbon monoxide and oxygen are removed, and the synthesis is effected under high pressure, the ammonia emerging as a gas ready for liquefaction or conversion into ammonium sulfate.

The principal application of ammonia is agricultural. When irrigation is practised, farmers use the ammonia as a fertilizer in liquefied form, when it is carried into the soil in highly dilute solution with the water. In the form of ammonium sulfate it is used on



land prior to irrigation, or on non-irrigated land. Ammonia is used also by large cities in the purification of water, in oil refineries as a neutralizing agent and corrosion preventative, and in cold-storage and ice-manufacturing equipment as a refrigerant. It is also a source of nitric acid for the manufacture of explosives, cellulose nitrate, etc.

The carbon which is left after the hydrogen has been removed from methane is processed further to meet the exacting requirements of the rubber industry. It has found wide acceptance as a soft carbon, such as is used in the compounding of rubber for hose, tubing, gaskets, and mechanical goods. That part of the carbon not suitable for this trade is made into briquettes which, because of their very low ash content and nearly zero sulfur content, have been found useful in metallurgy, more especially in steel production.

The production of alcohols, ketones, etc., from cracked petroleum gases has grown steadily in the past two decades. Thus, according to Tariff Commission reports, 37,500 gal. of isopropyl alcohol were made via the sulfation of propylene in 1922; 1,500,000 gal. in 1931; and 27,500,000 gal. in 1939. During this period the price fell steadily from $2.00 per gallon to 31 cents per gallon.

The process used by Shell Chemical Company for the production of alcohols from olefins consists of:

1. Production of pure hydrocarbon fraction containing only the olefin and its corresponding paraffin.
2. Absorption of the olefin content in concentrated acid to produce the alkyl hydrogen sulfates and dialkyl sulfates.
3. Separation of the products (2)from unreacted hydrocarbons.
4. Hydrolysis of the products (2) to ether alcohols or ether in dilute sulfuric-acid solution.
5. Removal of alcohols and ethers from solutions (4) by distillation.
6. Subsequent purification of alcohols and ethers by fractionation.

In this way isopropyl alcohol and diisopropyl ether are made from propylene, secondary butyl alcohol from α- and β-butylenes, and tertiary butyl alcohol from isobutylene.

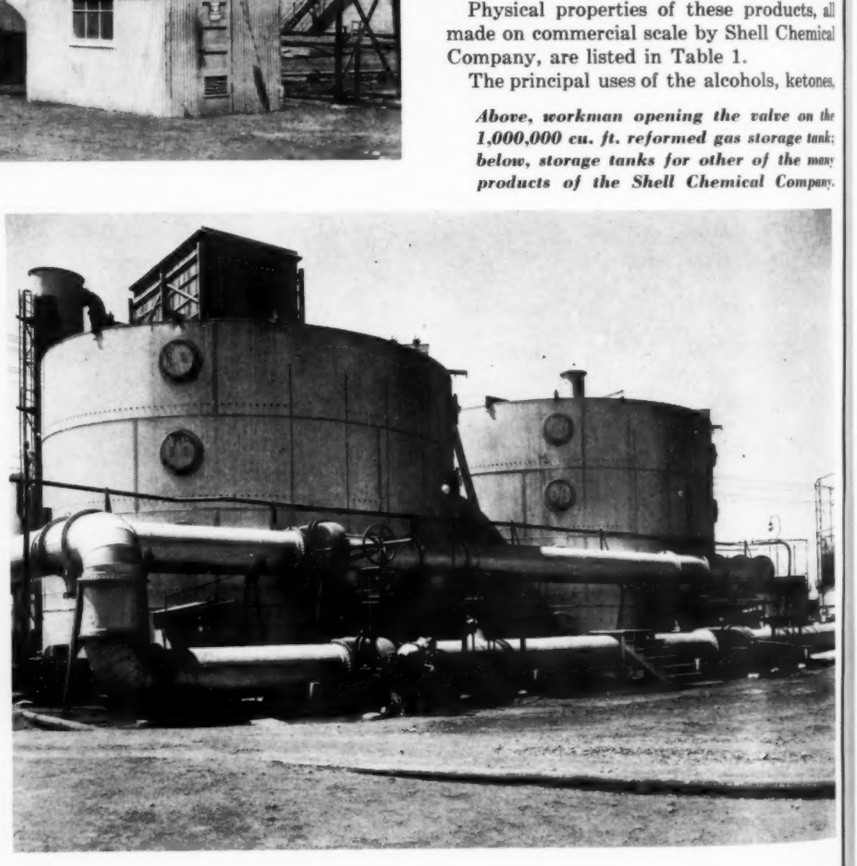
Acetone is made from isopropyl alcohol, and methyl ethyl ketone from secondary butyl alcohol, by catalytic dehydrogenation and subsequent fractionation. These two alcohols also are converted to the corresponding acetates by continuous esterification processes especially developed for this purpose.

From acetone a further series of products is made: diacetone alcohol by catalytic condensation of acetone at low temperature, and subsequent fractionation; mesityl oxide by the catalytic dehydration of diacetone alcohol; and methyl isobutyl ketone by the catalytic hydrogenation of mesityl oxide.

Physical properties of these products, all made on commercial scale by Shell Chemical Company, are listed in Table 1.

The principal uses of the alcohols, ketones,

Above, workman opening the valve on the 1,000,000 cu. ft. reformed gas storage tank; below, storage tanks for other of the many products of the Shell Chemical Company.



Irrigation ditch being fertilized with Shell Ammonia, one method of distributing this by-product of the oil fields to the roots of growing plants.

and esters are as solvents and extractants in the manufacture of lacquers, varnishes, and allied products, synthetic resins, plastics, synthetic fibers, artificial leather, safety glass, photographic films, printing inks, cosmetics, medicinal preparations, explosives, etc., and also in the dewaxing of mineral oils and extraction of vegetable and animal materials.

The alcohols and ketones have found extensive use as base material for chemical synthesis to make products such as esters, chlorides, ethers, xanthates, substituted hydrocarbons, fruit essences, perfumes, dyestuffs, wetting agents, and synthetic resins. Isopropyl alcohol, because of its complete miscibility with water, is used extensively as a component of anti-freeze solutions for automobile radiators.

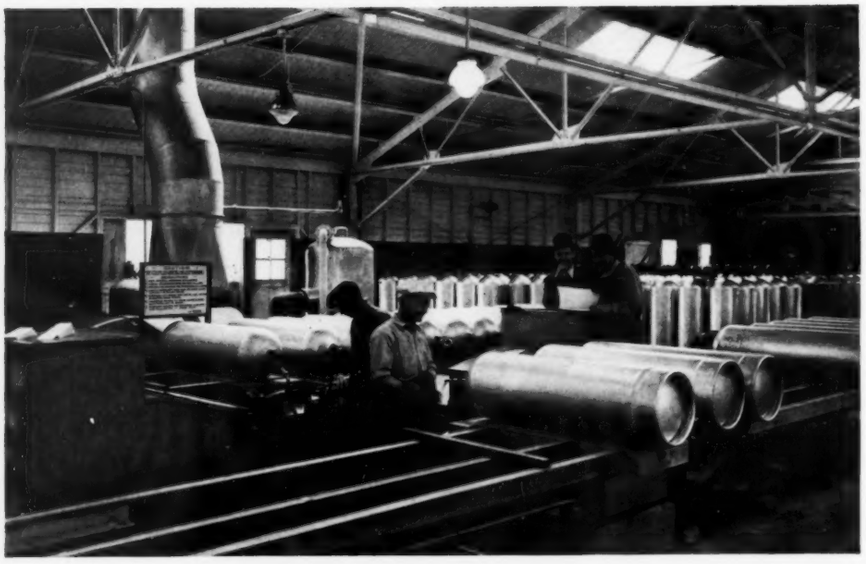
As a particular example of these olefin derivatives, let us consider methyl ethyl ketone—which until recently was available commercially only as a component of light acetone oil, a by-product of the wood-distillation industry. This mixture was limited in quantity and of uncertain composition, and never found extensive industrial uses. Since the introduction of synthetic methyl ethyl ketone from petroleum, a pure product of uniformly high quality, it has been consumed in increasing quantities by a variety of industries. For instance, it is an excellent solvent for nitrocellulose, with good tolerance toward the other materials that are used in lacquer manufacture, and in many of its properties it excels the esters as a lacquer solvent. It is also an exceptionally good solvent for the highly polymerized vinyl-type resins. It is used as a paint remover, an extractant in various applications, and a dewaxing agent for mineral oil. It finds extensive use in the processing of cellulose-acetate plastics, in the synthesis of rubber chemicals, and in the manufacture of rotogravure and intaglio inks.

Besides these major products, scores of others are in various stages of development in the research laboratories and pilot plants of Shell Development Company at Emeryville. Many of these are produced on semi-commercial scale; among them are several unsaturated chlorides and alcohols and their derivatives made from propylene and the butylenes via substitutive chlorination, followed by hydrolysis, chlorhydrination, etc. A number of these products, with physical properties, are listed in Table 2. The first commercially practical synthesis of glycerol was an outgrowth of these developments. This is now ready for full-scale application whenever economic conditions justify.

TABLE I

Properties of Pure Compounds

Compound and Chemical Formula	Molecular Weight	Specific Gravity (20/4 Deg C)	Boiling Point at 760 Mm. Mercury (Deg C)	Melting Point (Deg C)	Vapor Pressure at 20 Deg C (Millimeters of Mercury)	Flash Point (Closed Cup) (Deg F)	Pounds Per Gallon at 20 Deg C	Solubility with Water (Percent by Weight 20 Deg C)		Azeotrope with Water	
								Compound in Water	Water in Compound	Boiling Point (Dec C)	Percent by Wght. of Compo'd
KETONES											
Acetone: $CH_3CO.CH_3$	58.08	0.7898	56.1	—95.0	186.2	5	6.59	Complete	Complete	.....	.....
Methyl ethyl ketone: $CH_3CO.C_2H_5$	72.10	0.8047	79.6	—86.4	71.2	25	6.72	27.0	12.5	73.4	88.7
Methyl isobutyl ketone: $CH_3CO.CH_2CH(CH_3)_2$	100.16	0.8004	115.9	—83.5	15.2	60	6.68	1.7 (25 deg.)	1.9 (25 deg.)	87.9	75.7
Mesityl oxide: $CH_3.CO.CH:C(CH_3)_2$	98.14	0.8546	129.5	—59	8.0	83	7.13	3.1	3.1	91.8	65.2
Diacetone alcohol: $CH_3.CO.CH_2.COH(CH_3)_2$	116.16	0.9384	166 (approx.)	—47	0.84	144 (open cup)	7.83	Complete	Complete	98.8	12.7
ESTERS											
*Iso*propyl acetate: $CH_3COO.CH(CH_3)_2$	102.13	0.8719	88.6	—73.4	.....	39	7.28	2.9 (25 deg)	2.0 (25 deg)	76.6	89.4
Secondary butyl acetate: $CH_3COO.CH(CH_3).C_2H_5$	116.16	0.8711	112.4	.....	16.2	64	7.27	.....	.....	87	77.5
ALCOHOLS											
*Iso*propyl alcohol: $CH_3.CHOH.CH_3$	60.09	0.7848	82.3	—89.5	31.5	54	6.55	Complete	Complete	80.2	87.7
Secondary butyl alcohol: $CH_3.CHOH.C_2H_5$	74.12	0.8065	99.5	—114.7	12.1	73	6.73	24.4	56.0	87.5	72.7
Tertiary butyl alcohol: $(CH_3)_3.COH$	74.12	0.7791 (26 deg.)	82.4	25.6	57.3 (30 deg.)	48	6.50 (26 deg)	Complete	Complete	79.9	88.3
ETHERS											
*Iso*propyl ether: $(CH_3)_2CH.O.CH(CH_3)_2$	102.16	0.7238	68.4	—86.8	120.2	—6	6.04	1.0	0.5	62.2	95.5



materials. This resulted in a multiplicity of main and side reaction products, with attendant difficulties of separation and purification. An important advance in manufacturing technique has been the separation of the mixture of hydrocarbons before reaction into small groups, such as C_3 (propane and propylene) or C_4 (butane and the butylenes), and the rigorous exclusion of harmful impurities such as sulfur compounds.

Not only have yields been improved by this means, but the resulting products themselves are produced eventually in high purity and of the unquestionable uniformity which is necessary for their application in many industries. For example, acetone used in the manufacture of artificial silk must be free from even the minutest amounts of active

Left, cylinders of ammonia being filled and weighed before leaving the Shell Chemical plant to be used in agriculture: below, carbon from a filter in the ammonia plant being removed and conveyed to the Shell carbon plant.

Also in the stage of semi-commercial development is butadiene, which is of growing interest in connection with the manufacture of synthetic rubber. Both Shell Chemical and Shell Development Companies have been active in this development for a number of years, and have for some time been supplying from the small-scale plant at Emeyrville, Calif., several tons a week of butadiene to rubber manufacturers.

These are only illustrations of the possibilities of chemical products from petroleum; among the many developments not touched upon is the wide variety of products from ethylene, such as ethyl alcohol, glycol and glycol ethers, and derivatives of acetylene, whose production from methane and other hydrocarbon gases has been shown to be feasible.

In the manufacture of chemicals from cracked petroleum gases the pioneers in the industry had attempted to react fairly complex mixtures of the various olefinic starting

TABLE 2

Derived Chemicals from Olefins by Chlorination

Name	Formula	Molecular Weight	Boiling Point (Deg. C)	Specific Gravity (20/4 Deg C)	Flash Point* (Deg F)	Solubility in Water (Percent by Weight at 20 Deg C)
Allyl alcohol	$CH_2=\underset{\displaystyle CH_2}{CH}-CH_2OH$	58.08	97	0.852	70	00
Methallyl alcohol	$CH_2=\underset{\displaystyle CH_3}{C}-CH_2OH$	72.10	114	0.852	90	20
Allyl chloride	$CH_2=\underset{\displaystyle CH_2}{CH}-CH_2Cl$	76.53	45	0.937	−25	<0.1
Methallyl chloride	$CH_2=\underset{\displaystyle CH_2}{C}-CH_2Cl$	90.56	72	0.926	10	<0.1
Isocrotyl chloride	$CH_2-\underset{\displaystyle Cl}{C}=CHCl$	90.56	68	0.919	35	<0.1
1, 2, 3-trichloropropane	$CH_2Cl-CH-CH_2Cl$	147.45	156	1,391	170	<0.1
Diallyl ether	$CH_2=\underset{\displaystyle CH_2}{CH}-CH_2-O-CH_2-\underset{\displaystyle CH_2}{CH}=CH_2$	98.14	93	0.808	20	0.3
Dimethallyl ether	$CH_2=\underset{\displaystyle OH}{C}-CH_2-O-CH_2-\underset{\displaystyle CH_2}{C}=CH_2$	126.19	134	0.816	15	<0.1
Glycerol α-monochlorohydrin	$CH_2OH-\underset{\displaystyle Cl}{CH}-CH_2Cl$	110.55	213	1.320	280	00
Glycerol dichlorohydrin	$CH_2Cl-\underset{\displaystyle Cl}{CH}-CH_2OH$	128.99	182	1.362	200	13
Epichlorohydrin	$CH_2Cl-\underset{\displaystyle O}{\overset{\displaystyle /\backslash}{CH}}-CH_2$	92.53	117	1.181	90	6

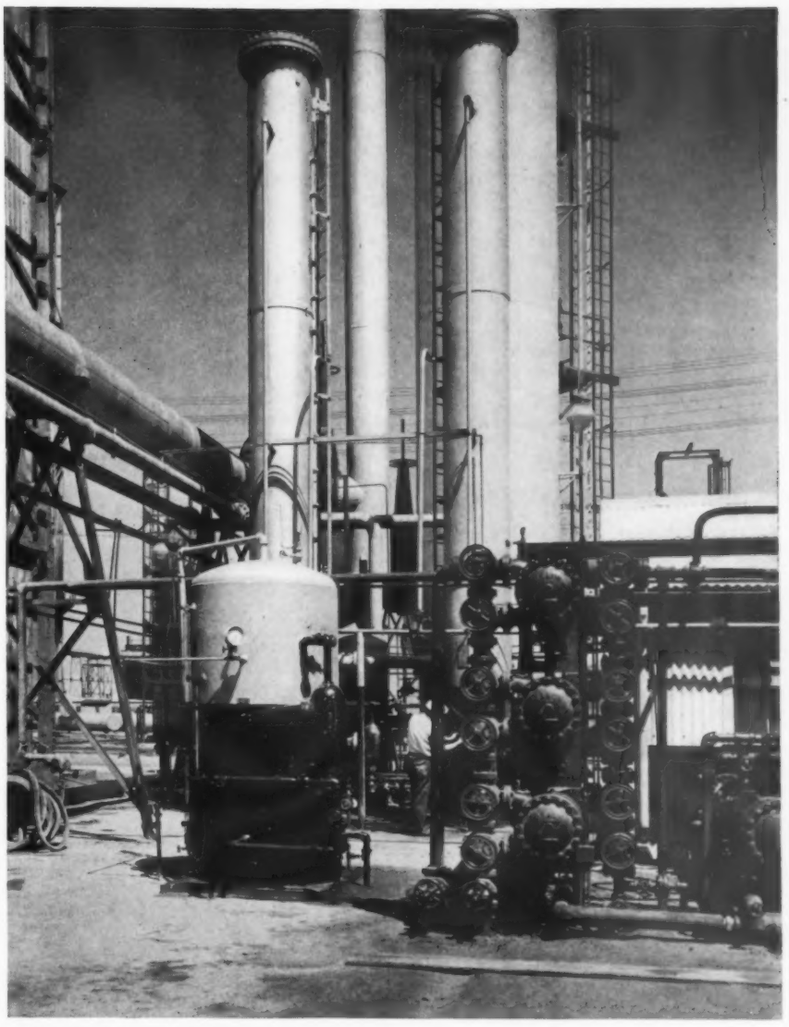
*ASTM open cup

sulfur compounds, i.e., such as would corrode the metal spinnerets, whose constancy of diameter controls the denier of the silk fiber. When we first proposed to make acetone from petroleum gases, the head of a leading artificial-silk company stated that it would be impossible to think of meeting his requirements in this particular direction. In solving this problem the research laboratory first had to devise analytical methods applicable in the range of interest, i.e., of the order of one to five parts of sulfur in 10,000,000 parts of acetone. The technique of such measurements was so perfected that we now are able not only to measure a total sulfur impurity of less than five parts in 10,000,000, but also to say within a 10 percent error how much of that impurity is due to the presence of free sulfur, hydrogen, sulfide, mercaptan, or other form of active sulfur.

By rigorous control of processing—including the purity of raw materials—guided throughout by such precise analytical procedures, acetone and other chemicals are produced regularly in a high state of purity. In fact, the high level of scientific standards and scientific control of manufacturing operations, which has been necessary in the petroleum chemical industry, has reflected to the benefit of the oil industry as a whole.

Moreover, important changes have been brought about in the fundamental economics of the oil industry, as a result of its entrance into the field of synthetic chemicals. Thus the guiding principle of Shell Chemical Company's first operations was to utilize refinery gases that otherwise would go to waste or, at most, be consumed as fuel. It would have been difficult to foresee the revolution in gasoline manufacture which was to come about as a result of one of the steps in secondary-butyl-alcohol synthesis—the step which consisted in removal of the isobutylene content of the feed by absorption in cold sulfuric acid, and recovery of the acid by heating, which polymerized the isobutylene to diisobutylene, the source of isooctane.

With the recognition of the possibilities of isooctane in aviation fuel came the development of the process as a refinery operation;



Benzol unit of the Shell Chemical plant.

and it soon became a question not of finding outlets for waste products, but of supplying enough raw materials for the needs in both chemical and synthetic-gasoline fields. This has led to the development, on the one hand, of the hot-acid polymerization process and the alkylation process, which utilize a greater proportion of the available hydrocarbon feeds; and, on the other hand, of processes for increasing the supplies of the key hydrocarbons.

Ammonium sulfate in bulk storage at the Chemical plant before shipment to farms.

Although prediction of future trends in the oil industry must be hazardous, there is no question but that chemical manufacture will play an increasingly important role. In some instances there actually may be a reversal of the original position, i.e., the refinery may be utilizing by-products of the chemical factory, and not the factory the by-products of the refinery. In any case, a close relationship may be expected as the operations of both expand into new fields.

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Trends in Automobile Design Match Evolution in Fuels

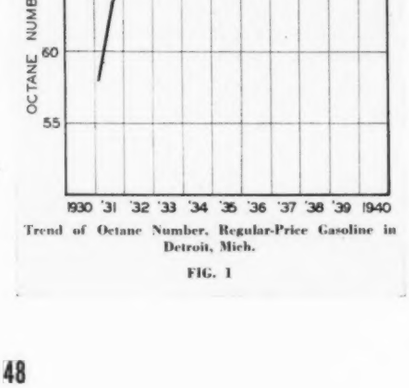
By T. A. Boyd and W. G. Lovell
Research Laboratories Division, General Motors Corp., Detroit, Mich.

Improvements in Automobiles Have Been Paralleled by Evolution of Motor Fuels - Reasonable Expectation That Mutual Evolution Will Continue in Future. An A. P. I. Paper Being Delivered at the Annual Meeting on November 15.

THERE are four trends in automobile design which have been sustained for many years—trends toward:

Greater comfort and better appearance;
Lower cost, both in purchase price and in operating expense;
Higher power; and
More miles per gallon.

These four trends, and in particular the last two, are influenced by changes in the gasolines currently sold in filling stations. In respect to this influence, it should be mentioned that it is gasoline, not the car, that sets the pace. That is to say, the car does not lead the gasoline trend, but follows it. Cars must not get ahead of the trend in gasoline, for it would be folly to build an automobile engine that could not run well on the gasolines currently sold. The car designer has to bear in mind also that, although a new model may be introduced every year, nevertheless, a car once made has an average life of eight years or more, and it must run on gasolines available over that period.

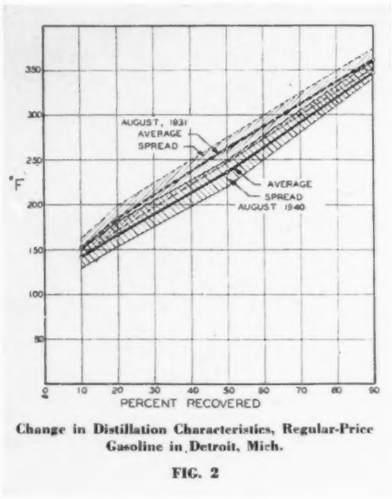


Trend of Octane Number, Regular-Price Gasoline in Detroit, Mich.

FIG. 1

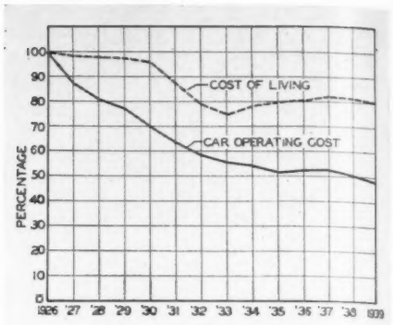
If the automobile trends toward higher performance and more miles per gallon are to continue, it is necessary; first to get more and more charge or air and fuel into a cylinder of given size; and, second, to use the charge there to better and better advantage. To crowd more charge into the cylinders, either mixture temperature must be lowered or the pressure drop in the induction system must be reduced, while keeping at the same time good distribution; or a positive pressure may be applied by means of a supercharger. This demands a volatile gasoline, of course, but one which is not so volatile as to bring on disturbances such as vapor lock. To use the charge to best advantage, mixtures must be as lean as permissible, and thermodynamic efficiency must be as high as possible. The latter can be accomplished only through high compression ratios—and this, of course, demands gasolines that are as knock-free as possible.

The foregoing introduction is an outline in brief of the discussion to follow, which consists chiefly in presenting more definite information on the trends mentioned, and on how closely they have followed changes in the characteristics of the gasolines currently sold.



Change in Distillation Characteristics, Regular-Price Gasoline in Detroit, Mich.

FIG. 2



Trend of Car-Operating Cost.

FIG. 4

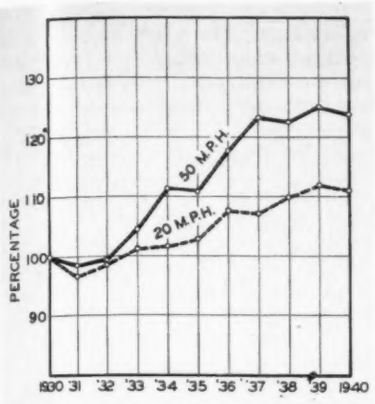
GASOLINE

The upward trend in octane number for regular-price motor gasolines during the period 1931 to 1940 is shown in Figure 1. As may be seen, the increase has been from below 60 to about 75 (ASTM values since 1933). In Figure 2 are shown changes in volatility, as measured by distillation temperatures at representative points. On the average, the decrease in distilation temperature, or the improvement in volatility, during the 10-year period amounts to more than 25 deg. F. at the 50-per-cent point, and to from 10 to 20 deg. at other points. The values given in Figures 1 and 2 are all for regular-price motor gasolines, as sold by the eight or nine major distributors in Detroit, Mich.

COMFORT

The first trend in automobile design mentioned at the outset, that toward more comfort and better appearance, is one of the most important of all, because these factors loom so large in the satisfaction of users. And the plentiful supply of gasoline at low cost, which always has been available, has exerted a major influence both upon comfort and appearance. This it has done by making it practical to build cars of large size and high performance. The higher cost of gasoline in Europe is an important one of the factors which have caused automobiles there to be smaller in size and lower in performance than those made on this side of the Atlantic.

The trend toward more volatile and more nearly knock-free gasolines also has influenced comfort and appearance, chiefly through the contributions to smooth and trouble-free engine operation. Another respect in which gasoline has influenced appearance is in such compromises in external lines as have been made to avoid trouble, from vapor lock. And such compromises have been made, even though in the petroleum industry it has been thought sometimes that automobile makers have not gone far enough in this regard.



Trend of Performance Factor, Brake Mean Effective Pressure Times Cubic Feet Displacement Per Ton-Mile.

FIG. 5

COST

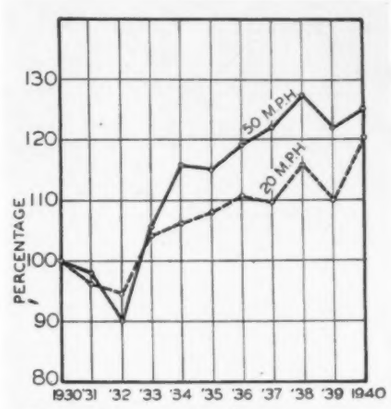
The second trend, that toward reducing the cost of owning and operating cars, has been a particularly pronounced one. The reduction in purchase price has been so large, in fact, that today the car buyer gets three times as much for his dollar as he did in 1920. A representative four-door sedan of 112-in. wheel base, which weighed 2,739 lbs., retailed in 1920 for $2,435. In 1939 a representative car of comparable size, one having the same wheel base of 112 in. and weighing 2,845 lbs.—four percent more—retailed at less than $735. Thus the 1939 car did not cost quite a third as much as the car of equivalent size and weight in 1920.* This tremendous reduction in the cost of cars is, of course, in addition to the further benefit which the car buyer receives today in the way of a more comfortable, more beautiful, and more satisfactory automobile.

PERFORMANCE

That there also has been a downward trend in cost of operation since 1926 is shown graphically in Figure 4. There it is seen that the direct cost of operating a car is only about half what it was in 1926. Cost of living, from the figures of the Bureau of Labor Statistics for 32 large cities, however, has decreased during the same period only 20 percent. The data on car-operating cost, from the Automobile Manufacturers Association, are direct operating costs for light passenger cars, based on records of 10 large fleets. These data do not include such fixed or indirect operating costs as depreciation, insurance, garaging, and license fees; but they do include gasoline, oil, tires, and repairs. The decreased cost of gasoline was, of course, one important factor in the downward trend in cost of operation. And there has been a reduction in the retail cost of gasoline since 1926, in spite of the almost year-by-year mounting of taxes on gasoline. Exclusive of the tax, the reduction in the retail price of gasoline has amounted since 1926 to about eight cents per gallon, whereas during the same period the tax on gasoline has risen about 2.5 cents per gallon on the average to about six cents.

The third major trend in automobile design is that towards more power. This is a trend of engineering design that also can be evaluated in definite figures. To make such an evaluation in as concrete terms as possible, for convenience we have taken as a basis a period of 10 years and six makes of cars that have been in high production for this pericd, and have expressed the trends in terms of averages for these six cars. Such a selection is somewhat arbitrary, to be sure, but the data have been dealt with so as to keep them as comparable as possible over this period.

In order to evaluate the trend, we have taken the performance factor as brake mean effective pressure times cubic feet displacement per ton-mile. This factor becomes comparable between different cars because it includes an adjustment for car weight and engine displacement. It is a measure of the relative amount of power that the driver has at his command to propel the car. In other words, it is what the driver may sense as the performance of the engineering package which he has purchased under the name of an automobile. As shown in Figure 5, the trend



Trend of Economy Factor, Ton-Miles Per Gallon.

FIG. 6

in performance has been definitely upwards and over the 10-year period an increase of about 25 percent has been achieved at 50 m.p.h and more than 10 percent at 20 m.p.h. (see also, for comparison, Figure 8).

ECONOMY

Accompanying such a very considerable increase in performance, there has been no sacrifice in fuel economy—but, on the contrary, a considerable gain. A graphical representation of this trend is shown in Figure 6, in which the percentage changes in the economy factor are plotted for speeds of both 50 and 20 m.p.h. This economy factor is taken as ton-miles per gallon, and over the 10-year period it shows an upward trend amounting to 25 percent at the higher speed, and to 20 percent at the lower speed.

*The 1939 car is used here for comparison, because later cars in the low-price field have wheel bases longer than 112 in. and weigh considerably higher. But aside from the increase in size, the comparision made in Figure 2 would hold also for the 1941 car. The comparison given is based on a more extensive analysis made by the Automobile Manufacturers Association and published in the booklet Men, Methods and Machines in Automobile Manufacturing 1939.

It may be emphasized again that this gain in economy has been achieved at the same time that performance has gone up, although it is often thought that at any one time increased economy may be had only with a sacrifice of performance, or vice versa. That these two trends towards more economy and performance have been manifested simultaneously is due to the engineering advances which have been made to match a simultaneous evolution of fuels, chiefly in octane number and in volatility. In other words, through automobile engineering, better use is being made of better fuels.

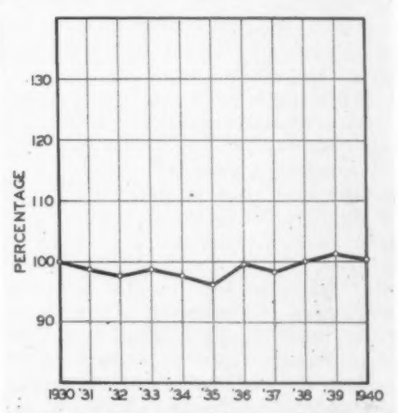
ENGINEERING TREND

The purchaser of an automobile might be said to be interested in performance and economy, without regard to the manner in which they have been achieved. But in considering these trends from the standpoint of the utilization of the fuels which to a large extent have made them possible, it is necessary to consider the design trends that are responsible for the final product. The problem of getting more performance and economy has been answered in part by putting more fuel into the same size engine, and in part by using it to better advantage.

The engine size itself has not been changed appreciably. Relative engine size, for the purpose of indicating trends, may be taken as cubic feet of engine displacement per ton-mile. As is shown graphically in Figure 7, the variation in this factor over this 10-year period has not been more than four percent up or down. The engines thus have not changed in relative size; therefore, as far as getting performance from cars is concerned, this must mean that more is being gotten out of them.

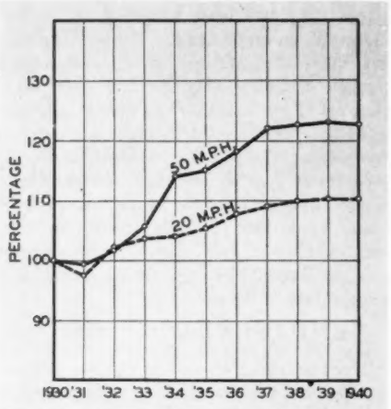
That there has been a trend towards getting more power out of a given size of engine is indicated by the data in Figure 8. These data, on the average brake mean effective pressures developed by this series of engines, show a fairly consistent increase, which over the 10-year period amounted to nearly 25 percent at 50 m.p.h. and to 10 percent at 20 m.p.h.

This increase in available power has come



Trend of Engine Size, Cubic Feet of Engine Displacement Per Ton-Mile.

FIG. 7



Trend of Engine Power, Brake Mean Effective Pressure at Full Throttle.

FIG. 8

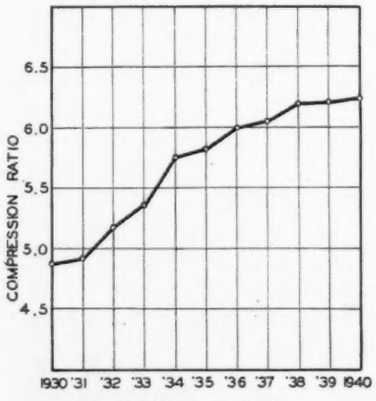
from a number of sources. One source has been an increase in compression ratio, made possible by better fuels and improved combustion-chamber design. This boost in compression has increased thermodynamic efficiency, and thus has yielded more power per unit of displacement. Although compression ratio of itself is not necessarily a reliable index of knock, nor of efficiency unless other factors are held constant, the trend in compression ratios is still of interest. Figure 9 represents the trend in the average of compression ratios over the 10-year period, and shows the average increasing from 4.7 to about 6.25. This trend represents but one aspect of getting more energy out of the fuel which is put into the engine, or of getting more power out of the same size engine, due to an increase in efficiency.

Another way to get more power out of an engine is to put a larger charge of fuel and air into it, or to make an engine that will breathe better. Doing this offers not only the advantage of higher power, but also of better economy when other adjustments are made. The trend of engine breathing is shown graphically in the chart of relative volumetric efficiency. Figure 10. This reveals an increase of about 10 percent in volumetric efficiency at 50 mph over the 10-year period. In other words, about 10 percent more fuel-air mixture goes into the engine.

This comes about not only from improvements in the induction system resulting in less restriction to the flow of air, but also from the use of cooler mixtures of fuel and air. The increase in mixture temperature above that of the air entering the carburetor may be taken as an index of mixture temperatures. The trend of this index is shown in Figure 11, which indicates a reduction of 15 to 20 deg. F. in the mixture temperature over the 10-year period under discussion. That it is possible to use cooler mixtures and to have induction systems with less restrictions is due in part to the improvement in the volatility of gasolines; and as a result the modern engine utilizes not only its fuel, but also its own materials of construction, to better advantage.

Another aspect of the better utilization of fuels by engines is the trend towards the use of leaner mixture ratios in automobiles over a period of years. The advantage of the use of lean mixtures is that it results in better gasoline economy, because less fuel is wasted or sent out the tail pipe as unburned carbon monoxide and hydrogen in the exhaust gas. It also has the accompanying advantage of reducing the possible hazard from carbon monoxide in the exhaust gas.

Data on this trend are not available year by year on the six automobile makes already considered. However, data are available from a paper yet to be published, in which surveys of mixture ratios were made in comparable and representative groups of cars in the years 1927, 1933, and 1940. Such data, in terms of mixture ratio over the speed range at road load, are shown in Figure 12. Greater improvements have been made at high speeds than at low, but in general the cars of the 1940 survey were operating with mixtures about two ratios leaner than those of 1927. This improvement of two ratios, which corresponds to a saving in fuel of about 17 percent,



Trend of Compression Ratio.

FIG. 9

contributes largely to the gains in miles per gallon shown in Figure 6.

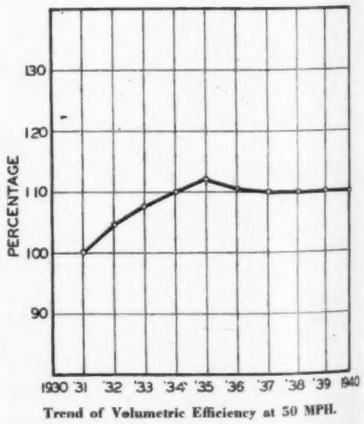
This improvement in mixture ratio has been made possible primarily by advances in carburetor and induction systems, with resultant improvement in fuel distribution. And this has been possible in turn because of improvements in the volatility of gasolines. Only part of the resultant improvement has been taken directly as economy. Part of it was utilized for improving performance.

Viewed as a whole, the trends in engineering design, which have put more performance and economy into the automobile, seem to match the evolution in gasoline shown in Figures 1 and 2. Thanks in part to more volatile gasolines, automobile engines are breathing more freely, and they also are breathing cooler air. Leaner fuel-air mixtures as well are being used. Furthermore, due in part to boosts in compression made possible by more nearly knock-free gasolines the charge once in the engine is being used more efficiently. Thus all of these changes in engineering design not only have been correlated among themselves to produce a cheaper yet better final product, but they also have been matched with the evolution in fuels.

THE FUTURE

Still further advances can be made, for the end of what is possible has not yet been reached. This is true from a technical standpoint at least, and probably also from an economic one. As an indication of what can be done with fuels of higher octane number, there are presented in Figure 13 some experimental data obtained on a car in which a fuel of approximately 100 octane number was used instead of 70 octane number. When the 100-octane fuel was used, the compression ratio of the engine was increased as found possible for equivalent knock. This, of course, of itself would increase greatly the performance of the car; and in order to take the greater part of the gain of high compression as economy rather than performance, the axle ratio of the car was changed so as to maintain the original performance of the car at 20 to 30 mph. The results, reduced somewhat at the low speed from the data as obtained in order to show gains due to the change in octane number alone, are presented in Figure 13. At 20 mph, where the increase was altogether in miles per gallon, it amounted to more than 40 percent. At the higher speeds the gain in miles per gallon was not quite so large. These lower values were due in part to the shape of the power curve of the high-compression engine. This was such as to give a residual gain in performance above that which could be converted into an improvement in miles per gallon without major engineering changes, which in these experiments it was desired to avoid.

It may be of interest to present further, in Figure 14, similar data for the same engine with the compression boosted to a ratio of 10.3:1, and with axle ratio further changed to give the original performance at 20 to 30 mph. At this compression the fuel required was above 100 octane number; but the gains in miles per gallon were about 70 percent at 20 mph, about 65 percent at 40 mph, and about 50 percent at 60 mph. Here, as before,

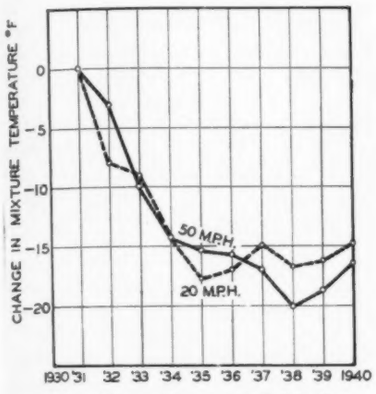


Trend of Volumetric Efficiency at 50 MPH.

FIG. 10

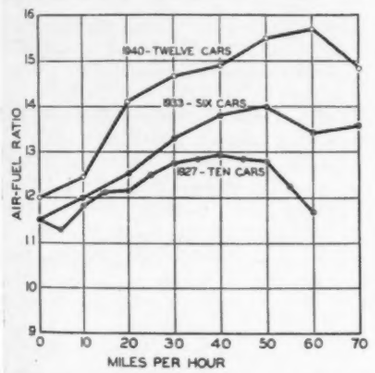
there was a residual gain in performance at the higher speeds. From these two items of direct experimental evidence it is apparent that, in spite of the sometimes expressed belief that nothing much can be gained by going higher in octane number, quite the contrary is true.

However, under some conditions, mechanical limitations may impose a barrier to the use of very high compression ratios. But even in such engines it appears possible, through the use of supercharging, to utilize high-octane fuels to advantage, and perhaps with gains in miles per gallon almost as large as those obtained by raising compression ratio. The practicability of supercharging automobile engines has not yet been fully explored,



Trend of Mixture Temperature, Full Load.

FIG. 11

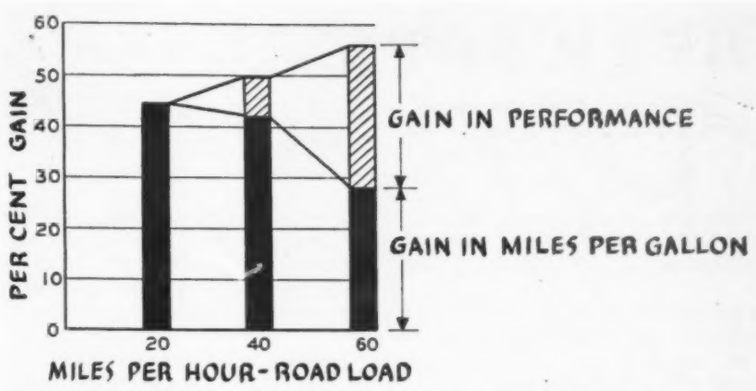


Mixture Ratios in Representative Groups of Cars for Various Years, Road Load.

FIG. 12

of course. Nevertheless, an attempt, based upon such limited experimental data as are available, has been made to estimate the gains in miles per gallon which a car with a supercharged engine using 100-octane gasoline would give, compared with an unsupercharged one of the same compression ratio using 70-octane gasoline. For this purpose two assumptions were made: First, that for the same performance engine displacement could be reduced by 45 percent; and, second, that the supercharger would be operative only in the case of power demands at a given speed above the output of the unsupercharged engine. At road loads the smaller engine thus would operate at a load factor distinctly higher than would the original engine, and that is how the gain would be made. For, on the basis of experimental data relating load factor and specific fuel consumption, which improves rapidly with load factor, it was estimated that the resulting increases in load factor would give gains in miles per gallon at road load varying from about 35 percent at 20 mph to 20 percent at 60 mph.

The data presented above on what may be obtained with high-octane fuels may or may not indicate a future trend. However, they surely do show that, with still better fuels and with automobiles engineered to fit them, it is at least technically possible to make further improvements which will be as large or larger than those made in the past decade.



Gains with Fuel of Approximately 100 Octane Number Compared with 70 Octane Number.

FIG. 13

CONCLUSION

Thus the advances achieved year by year in fuels and in cars have been made to supplement one another in such a way as to give people better products, and at lower cost. The consistent growth and success of the oil and automobile industries indicate that car users have given these improvements their enthusiastic approval. And so it seems reasonable to expect that this mutual and advantageous evolution in fuels and engines will be continued as future technical and economic advances permit.

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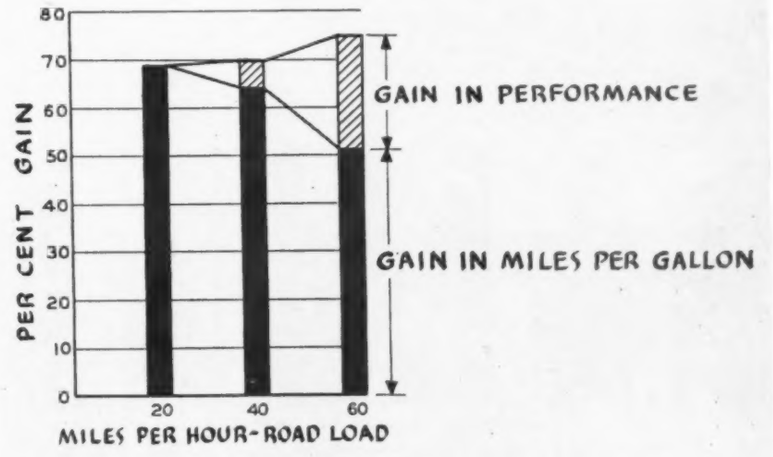


Gains with Fuel of More Than 100 Octane Number Compared with 70 Octane Number.

FIG. 14

ABSTRACTS of Leading A.P.I. Papers

By Dr. O. W. Willcox

Factors Affecting Reservoir Performance. R. D. Wyckoff, before AMERICAN PETROLEUM INSTITUTE, Chicago, November, 1940.

Any consideration of factors affecting reservoir performance requires first a definite commitment concerning the basic principles underlying the performance without which elaboration upon details is meaningless. Thus the discussion dwells at some length upon this phase of the question. The concepts of reservoir mechanisms which have been outlined represent, in the writer's opinion, the accepted modern views. On this foundation the more important factors involved, together with some related details, have been reviewed. Other factors not considered here, and their role in the performance, will be evident in the light of the fundamentals as outlined. In view of the general scope of the discussion, no attempt has been made to outline techniques for determining factors other than in those instances when proper emphasis has required it.

Fuel-Quality Requirements as Affected by Items of Motor Maintenance. H. M. Trimble and K. C. Bottenberg, before AMERICAN PETROLEUM INSTITUTE, Chicago, November, 1940.

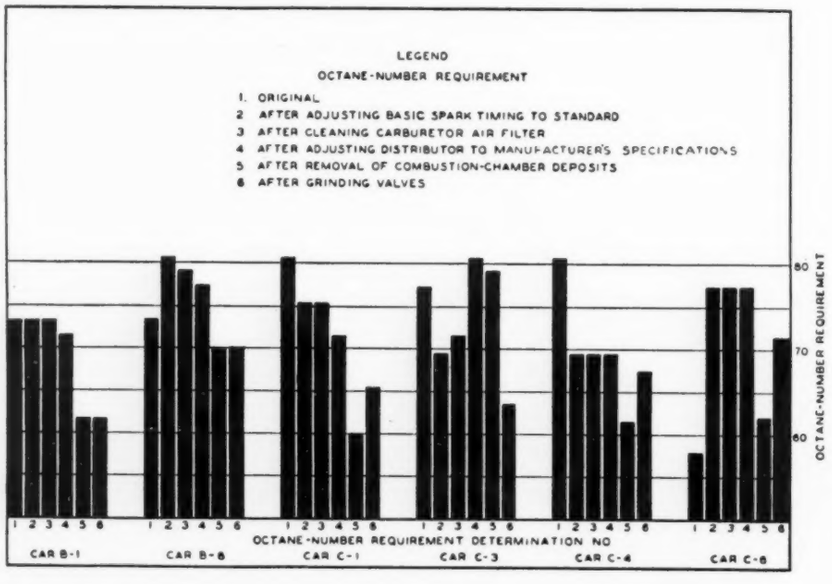
A number of items of motor maintenance which exert an influence on fuel-quality requirements for trouble-free operation. are listed and discussed. Such items appear to fall logically into two classes, viz., those which contribute to place restrictions on the volatility characteristics of fuels, and those which contribute to determine required anti-knock characteristics.

A series of road tests on 18 cars is reported, in which the effects of various maintenance items on octane requirements were investigated.

Only one of the five items of maintenance investigated showed consistent results in the direction of lower octane requirements. This item was the removal of combustion-chamber deposits, and the effect ranged anywhere from 1.6 to 15.5 octane numbers. The data show no definite relationship between octane-requirement decrease and miles driven since last carbon removal. Doubtless this variation is caused to a great extent by such factors as the type service to which the car is subjected, the amount of oil entering the combustion chamber through faulty rings, etc. However, it would appear from these tests that possibly about 15 or 16 octane-number decrease is the maximum that might be expected, whereas a decrease of 8 to 10 octane numbers in the requirement more nearly might represent an average case. It is also apparent that a 13- to 15-octane-number increase may occur in as few as 15,000 miles.

The only thing which can be said of the remaining four items of maintenance investigated is that they have definite effects on octane requirements, although the effect is not always in the same direction. The final average difference between the octane requirements of all the cars—as received, and after adjustments and corrective measures had been applied—was 8.7 octane numbers. Excepting the cars on which only the effect of carbon removal was studied, a decrease in requirement from an initial average of 75.5 octane number to a final average of 66.0 octane number, or 9.5 units, was secured.

In view of this great difference in octane requirements, which appears to be largely a matter of combustion-chamber deposits, one naturally wonders about the factors which might contribute to a rapid building up of deposits. Excessive choking due to badly adjusted or inoperative automatic chokes, and the condition of rings and pistons, undoubtedly play an important part in the rapid building up of combustion-chamber deposits, and as a consequence deserve some consideration on the customer's part.



The Octane-Number Requirements of Six Cars After Performing Each of the Indicated Items of Maintenance.

Protection Against Static Electricity. J. M. Pearson, before AMERICAN PETROLEUM INSTITUTE, Chicago, November, 1940.

Static electricity is one of the hazards attending the handling of petroleum products in the open. These hazards are encountered especially in the operation of oil trucks on the road due to road friction, and in the flow of oil into tanks. Others arise from lightning, static charges on men (gagers), on customer's automobiles and belt-driven equipment. The nature of the several cases are explained and counter measures suggested.

Engine Performance as Influences by Ignition Timing Maintenance. R. J. Greenshields and L. E. Hebl, before AMERICAN PETROLEUM INSTITUTE, Chicago, November, 1940.

It is recognized generally that the best performance for which an engine can be designed is limited by the anti-knock value of the fuels available. The attainment of this peak performance requires a delicate combination of spark timing and compression ratio; consequently, the continued maintenance of that adjustment of the timing mechanism which the engine designer intended to be used is necessary if best performance is to be expected.

The accumulated information indicates that timing mechanisms of a small percentage of cars are allowed to become advanced in service, so that the octane requirements of those cars are increased sufficiently to cause present-day fuels to knock, with no improvement in engine performance. An even larger percentage of cars has been found to operate with the spark timing retarded excessively, causing definite reduction in performance.

Although the importance of correct spark timing has become common knowledge through the cooperative studies of various

groups, it can be likened to the weather, concerning which Mark Twain once said that nobody ever does anything about it. Greater care in maintenance of correct timing not only would ensure improved performance with present-day fuels—it also would reduce the number of cases in which detonation is obtained with today's fuels.

The authors go on to say that although the general high level of octane requirements is caused to a considerable extent by the accumulation of combustion-chamber deposits, the excessively high octane numbers of present-day gasolines are a wasteful attempt to satisfy the few cars which have excessively advanced spark timing—often with actual reduction in performance.

Economics of Controlling Water Produced with Oil. J. N. Teague, before AMERICAN PETROLEUM INSTITUTE, Chicago, November, 1940.

The economics of doing remedial work to exclude the water from wells producing water and oil is a problem of serious concern to the operator.

The production of water in some fields is, no doubt, injurious to the oil-producing reservoir, and should be excluded to conserve reservoir energy and increase ultimate recovery. In many other fields there is no apparent damage to the reservoir by the production of water, and any remedial work done must be justified by the saving in operating cost resulting from not having to lift the water and then dispose of it.

The principal factors which should be considered in determining the economics of remedial work are set forth in considerable detail; an outline is given of records and data necessary for analyzing a given problem together with the cost of installing and operating salt-water disposal plants in four fields of southern Louisiana.

The author discusses the development of procedure and equipment now being used successfully in detecting relatively small quantities of oil, water, and gas brought to the surface from the bottom of a drilling well by mud-circulating fluid used in rotary drilling, together with the method used in determining the depths of the horizons where the samples entered the well bore.

He describes in detail a number of instruments that have been placed upon a panel and installed in a trailer; the trailer is moved from location to location as the drilling rig is moved. Most of these instruments are concerned with the logging of the well as drilling progresses. With these new instruments and methods it now is possible to drill ahead continuously, and to know fairly accurately the type of formation that is being drilled through—its oil, water, and gas contents, and its depth. Information of this nature, obtainable while drilling, is quite helpful—not only in determining completion procedures, but also may become useful in the later life of the well in producing or reconditioning operations.

The trailers and service now have been commercially available a little more than a year, and have been used on approximately 200 wells. In addition to logging, at present the trailers are equipped for routine drilling-mud control and for core analysis. The development is in the early stages, and it is expected that other functions connected with the logging and operation of drilling wells will be added as time goes on.

Use of Lecithin in Gasoline. H. E. Rees, W. S. Quimby and J. C. D. Osterhout, before AMERICAN PETROLEUM INSTITUTE, Chicago, November, 1940.

Lecithin, obtained from soybeans, is a phosphatide found to be effective in improving leaded and unleaded gasoline quality and stability. It has little effect on initial or dark storage color, but markedly reduces decolorization as well as haze and deposit formation when exposed to sunlight, as in gasoline-dispensing pumps. Its use results in decreased corrosion of storage-tank bottoms, and of galvanized drums, particularly those containing highly leaded aviation gasolines in which the formation of zinc-oxide deposits often requires filtration prior to consumption. Reduced aluminum corrosion in aviation-gasoline tanks due to moisture condensation also was found. Dosages required range from 1 lb. to 15 lb. per 1,000 bbl.

It is pointed out that this use of lecithin should mean an enlarged outlet for the farmers' soy beans.

Oil Recovery by Air Drive in the Venango Fields of Pennsylvania. Parke A. Dickey and Robert B. Bossler, before AMERICAN PETROLEUM INSTITUTE, Chicago, November, 1940.

The secondary recovery of oil by air drive for approximately 15 years has been practiced generally in the Venango oil fields of northwestern Pennsylvania. Hitherto no attempt has been made to analyze the results and estimate the quantity of oil recoverable by this method.

The production-decline curves of properties on which no new development has taken place over a period of several years approximate straight lines on logarithmic paper. Following accepted procedure, the economic life and cumulative ultimate oil recovery of the properties thus may be predicted. Unfortunately predictions could be made for only a few of the older properties and for none of the newer developments because, on most leases, new work so affected the oil production that no conclusions could be drawn. Twelve leases showed suitable curves. The estimates of cumulative ultimate recovery range from 11 bbl. to 100 bbl. per acre-foot, with an average of 42 bbl. The economic life ranges from 9 to 48 years, with an average of 28 years.

Whereas a large number of factors affects the recovery of oil by air drive, it is believed that the principal ones are the original oil and water content of the sand, the spacing of the wells, and the efficiency of the application of air to the sand. The latter factor seriously is affected by the bypassing of air through the more permeable beds, and is difficult to take into account.

It is suggested that ultimate oil recovery and well spacing are connected by an equation of the type:

$$y = ae^{-bxP}$$

Tentative values, based on the available data, were assigned to the constants.

Compressor plants range from small makeshift outfits to large two-stage compressors with capacity up to 1,000,000 cu. ft. per day at pressures up to 400 psi.

The mixture of air and gas collected from the casing-heads is used for fuel, and the surplus is returned to the sand. In order to avoid mixing the surplus with the compressed air, it usually is handled during certain hours only, or by a separate compressor. On some leases the gas from the wells is 50 to 75 per cent combustible; on others it is almost pure air.

Fluid-Meter Research at the University of Oklahoma. W. H. Carson and E. E. Ambrosius, before AMERICAN PETROLEUM INSTITUTE, Chicago, November, 1940.

The University of Oklahoma, School of Mechanical Engineering, in cooperation with the Special Research Committee on Fluid Meters of the American Society of Mechanical Engineers, for the past several years has been conducting research on meters for the measurement of oil.

The first tests were performed on inferential-type meters such as orifices, nozzles, and venturi tubes on 1½-in., 2-in., 3-in., and 4-in. lines. Diameter ratios from 0.125 to 0.84 were employed, and the Reynolds numbers ranged from 50 to 60,000. This phase of the work was started in 1932 and is now complete. The data are in the hands of the committee, and a report is being prepared.

At present, attention is being directed toward the displacement type of meters, particularly those meters that are designed for the metering of oils. These meters range in size from 1½ in. to 6 in. Meter-accuracy tests are made at the University of Oklahoma, where special equipment is available. With this equipment it is possible to vary the flow rate through any meter from about 5 percent to 125 percent of its rated capacity, the maximum rate of flow being 450 gal. per min. During the tests the medium-grade oil in the system was heated by suitable heat exchangers, thus varying its viscosity. Thus information is obtained on viscosity and temperature effects. To insure accuracy the meter readings were taken with the aid of a camera.

The results of the volumeter research show the general characteristics of the meters to be as follows: (a) slip in sealing; (b) pressure-slip relationship; (c) mechanical and hydraulic friction; and (d) pressure drop resulting from fluid friction and in driving metering parts.

The general conclusion on the measurement of petroleum and its products through the use of meters and a closed pipe-line system is that:

1. Under normal conditions of measurement and installation, the meter has an economic advantage over the conventional tank gaging methods.

2. The change from one method of operation to another generally requires consider-

able time; often a company must use older and less efficient equipment until it has reached such a degree of obsolescence that it is economically feasible to replace it with something better— which is true in the adoption of oil meters.

3. The developmental engineers of the various oil-meter-manufacturing companies are to be commended for their fine work in developing the present-day meters; however, there is still need for improvement in the mechanical characteristics and wearing qualities of the meters, to make them adaptable over a wide and more varied range of operating conditions.

The Naphtha Polyform and Gas Reversion Process. J. E. Bogk, P. Ostergaard and E. R. Smoley, before AMERICAN PETROLEUM INSTITUTE, Chicago, November, 1940.

High yields of motor fuels with CFR-ASTM octane numbers of from 70 to 80 are obtained from gas reversion and polyform operations. Theoretical discussion of improved gas-naphtha conversion results obtained in these processes is presented. "Cooperation" is obtained with mixed propanes, butanes, and naphtha; and polymerization, alkylation, and other synthesis reactions take place. The dilution of naphtha with gases has a pronounced physical effect on naphtha reforming, permitting increased conversion per pass with less tendency towards coke formation. Commercial application, operating flow sheets, and data from polyform and gas reversion units are presented. Equipment and operation of these units, as well as the distillate treating, are conventional and similar to thermal cracking. Commercial operations extend over four years, with 10 units now operating and two units under construction, which altogether will process 55,000 bbl. per day of naphtha and outside propanes and butanes. The polyform and gas reversion processes give increased yield and increased octane number, and the gasoline produced has good distillation characteristics and lead response. Investment and operating-cost curves presented with this paper furnish means for obtaining economic realizations. These show one- to two-year payoff on investment, and demonstrate that these refining methods have a place in the petroleum industry.

Trends in Automobile Design Match Evolution in Fuels. T. A. Boyd and W. G. Lovell, before AMERICAN PETROLEUM INSTITUTE, Chicago, November, 1940.

Viewed as a whole, the trends in engineering design, which have put more performance and economy into the automobile, seem to match the evolution in gasoline. Thanks in part to more volatile gasolines, automobile engines are breathing more freely, and they also are breathing cooler air. Leaner fuel-air mixtures as well are being used. Furthermore, due in part to boosts in compression made possible by more nearly knock-free gasolines, the charge once in the engine is being used more efficiently. Thus all of these changes in engineering design not only have been correlated among themselves to produce a cheaper yet better final product, but they also have been matched with the evolution in fuels. (This paper is reproduced in full on page 48 of this issue—Editor.)

Synthetic Chemicals from Petroleum. L. Rosenstein, before AMERICAN PETROLEUM INSTITUTE, Chicago, November, 1940.

The manufacture of synthetic chemicals from petroleum and natural gas has been one of the major developments in the chemical industry during the past decade. As an example, Shell Chemical Company's production of ammonia has increased from 4,500 tons in 1931 to 27,000 tons in 1939; of solvents from 90,000 lb to 57,000,000 lb in the same period. A continually increasing variety of chemicals of exceptionally high purity is being made available at constantly decreasing cost, from cheap raw materials whose supply is stable, abundant, and remarkably adaptable. Alcohols, ketones, and esters made from refinery gases that formerly were used only as furnace fuel now are known quite well to chemical markets. (This paper is reproduced in full on page 43 of this issue—Editor.)

The Emulsion De-Oiling Process. A. H. Schutte, before AMERICAN PETROLEUM INSTITUTE, Chicago, November, 1940.

This paper presents a new process for de-oiling crystalline waxes, and summarizes the pilot-plant and commercial operations. The process utilizes water emulsions to effect continuous wax-oil separations. No expensive solvents nor solvent-recovery equipment is required. The processing time is a matter of minutes, rather than of days; and, therefore, automatic control is immediately effective. The plant cost and operating cost are low, and only exhaust steam is required for heating. The method may be applied to the complete processing of slack wax to semi-refined grades, or may be used as an adjunct to existing sweating equipment.

The theory of the process is summarized as follows:

If an oily crystalline wax stock is cooled to a temperature below its melting point, the wax solidifies in well-defined crystals; but the system is not freely separable because the wax crystals impede the flow of the oil, and because the oil adheres to the crystals. An attempt to filter the material results in very imperfect separations and difficulty with plugging of the filter medium. If, however, the oily wax is emulsified in a non-viscous non-solvent liquid, such as water, and cooled to precipitate the desired wax, with the process so controlled that the water is the continuous phase of the emulsion, then the droplets of oil and the wax crystals are separated by water, and a freely filtering substance is obtained. In practice the cooling and emulsification usually are carried out in the same zone by the addition of the non-solvent liquid at a suitable temperature. The resulting material, which has the appearance of whipped cream, may be subjected to any kind of a liquid-solid separation, such as filtration or settling. The cake deposited on filtration, when the water and oil have been removed, is finely crystalline, porous, and may be washed readily with large volumes of water. The process has the unique features of employing non-solvent liquids, rather than solvent liquids, and of utilizing emulsions which up to now have been considered as undesirable nuisances by the petroleum refiner. In addition to the aforementioned benefits of emulsification, there is apparently an improvement in crystal structure, due to the fact that the wax is solidified from a thin interfacial film, rather than from the main body of a liquid.

The process (patented) is licensed by the Lummus Company.

A. P. I. Pipe-Coating Tests—Final Report No. 5. Kirk H. Logan, before AMERICAN PETROLEUM INSTITUTE, Chicago, November, 1940.

This report relates to a study of protective coatings for pipe lines for the purpose of establishing the engineering principles involved in the design, selection and applications of such coatings. The plan of the study which was initiated in 1930, was to apply the products of the cooperating manufacturers to operating lines and lengths of pipe which were buried at a number of selected sites in the Gulf Coast, the Mid-Continent, Pennsylvania and California. The tests have been inspected and reported on at intervals. This final report deals with tests on operating lines and short coated sections.

Following are some of the facts and engineering principles established by the test:

1. Many of these coatings will reduce greatly corrosion during at least 10 years (the period of this test)—although complete protection from all corrosion has not been realized in corrosive and destructive soils.

2. The effectiveness of all coatings tested decreased throughout the period of the test. This in most cases is the result of continued soil pressure and the absorption of water. There appears to be little change in the coating materials other than the organic fabrics used as reinforcements or shields.

3. Shields and reinforcements should be permanent and sufficiently rigid to distribute soil stress and pressure due to the weight of the pipe over such areas as will avoid flow of the bituminous or other material used in the coating.

4. Thickness of material is an important factor in coating construction.

5. A coating should be sufficiently rigid to withstand pressures over long periods, and elastic enough to withstand stresses resulting from pipe movement and sudden changes in temperature. These requirements are difficult to reconcile.

6. A coating which fails to protect at a few points may cause, under certain conditions, deeper pits than would have occurred on uncoated pipe in the same location.

7. Many soils are only mildly corrosive, and no protective coating is required in them unless the cost of a leak is abnormally high.

8. The economics of the general problem should be considered.

A list of materials used is appended to the report.

A Comment on the Viscosity Classification of Lubricants. W. S. James, before AMERICAN PETROLEUM INSTITUTE, Chicago, November, 1940.

Attention is drawn to the fact that when the ranges of motor oils outlined by the SAE viscosity classification are plotted on the same chart the result is overlapping and confusion, which is perhaps one of the reasons why the full value of a viscosity classification has never been realized. On the other hand, when the SAE classification for transmission and rear-axle lubricants is plotted, the chart is understandable and usable. The question is therefore raised as to whether it is impractical to work out a viscosity classification for motor oils in which there will be much less overlapping of ranges at the more commonly-used temperatures. The author makes a proposal in this direction, wherein the limits are temperature limits at a given viscosity instead of viscosity limits at a given temperature.

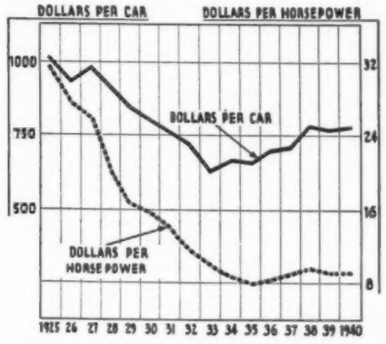
Use of Azeotropic Distillation in Separating Hydrocarbons from Petroleum. Frederick D. Rossini, Beveridge J. Mair and Augustus R. Glasgow, Jr., before AMERICAN PETROLEUM INSTITUTE, Chicago, November, 1940.

Azeotropic distillation may be described as follows: Assume a mixture of two hydrocarbons of different type, as a paraffin and an aromatic, which have the same boiling point. These two hydrocarbons cannot be separated by ordinary distillation at the given pressure. However, there may be added to this mixture a third substance, which has the property of changing by different amounts the boiling points of the two hydrocarbons in the mixture and so making them separable by distillation in the presence of this added substance. The first part of the distillate will be a constant-boiling azeotropic mixture of one hydrocarbon with the added substance, and the last part of the distillate will be another constant-boiling azeotropic mixture of the second hydro carbon with the added substance. The process of distilling in the presence of such an added azeotrope-forming substance constitutes azeotropic distillation. The added substance subsequently is removed from the azeotropic distillate in an appropriate manner.

The present paper explains the principles. A subsequent paper in the Journal of Research of the National Bureau of Standards will give details concerning the actual results obtained in the laboratory in separating aromatics from naphthenes and paraffins, naphthenes from paraffins, aromatic hydrocarbons of different degrees of "aromaticity," and naphthene hydrocarbons of different degrees of "naphthenicity." In this same paper are given a discussion of the benefits of distillation of the mixture of hydrocarbons at reduced pressure prior to their separation by azeotropic distillation, and also a list of the hydrocarbons known to be separable from petroleum by distillation alone.

Heavy-Duty Motor Oils. H. C. Mougey, before AMERICAN PETROLEUM INSTITUTE, Chicago, November, 1940.

With improvements in engines, fuels, and roads, the service requirements on gasoline and diesel engines are increasing rapidly. This means that the lubricating oils should be able to lubricate the engines under the heavy-duty service conditions that are becoming more common.

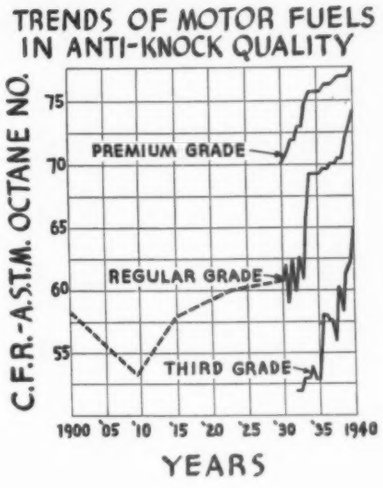


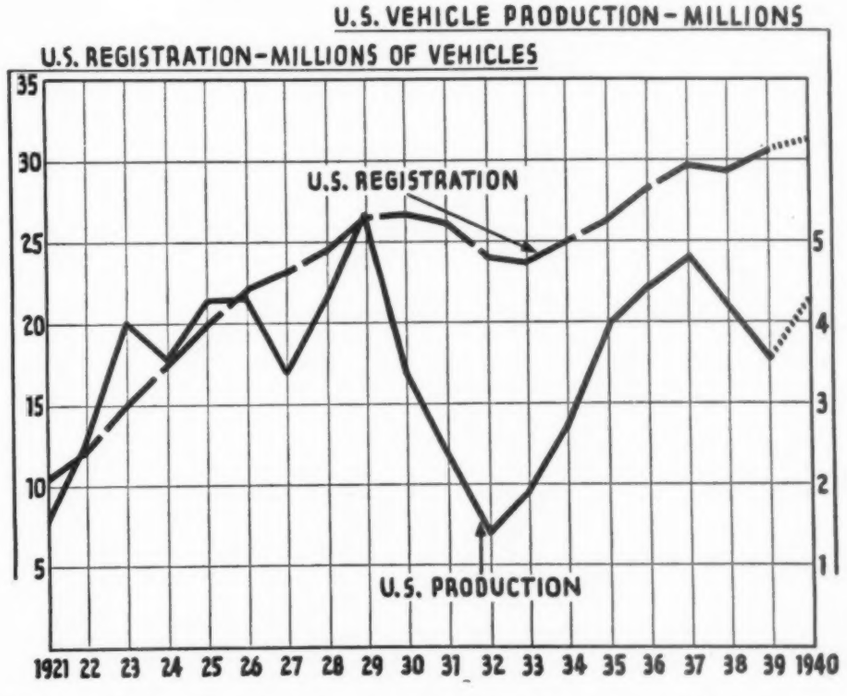
Trend in Costs of Automobiles (Data from *Automobile Facts and Figures*, 1940).

In order to meet these requirements, the lubricating oils should be resistant to oxidation or chemical decomposition in the crankcase; the oil must not be corrosive to engine parts; the products of thermal decomposition in the combustion chamber should not be excessive; and the oil should be of such a nature that the decomposition products that get into the oil will not adhere too strongly to pistons, rings, or other engine parts.

Oils and fuels are just as much parts of the engine as pistons and crankshafts. Progress in engines and progress in oils and fuels must go hand in hand, and neither the oil nor automotive industry can make much progress by itself, or if progress lags behind in the other industry.

[Other papers delivered on the Annual meeting of the A. P. I. will be abstracted in the December issue of World Petroleum—Editor].





Automobile Registration and Production (Data from *Automobile Facts and Figures*, 1940).

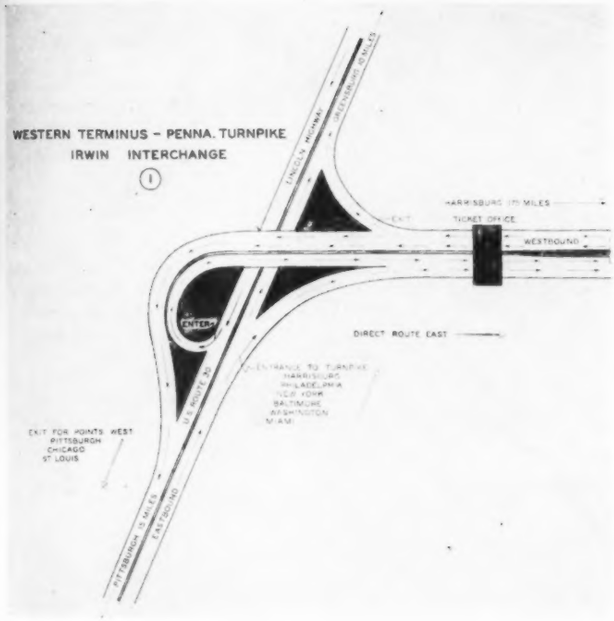
PENNSYLVANIA TURNPIKE

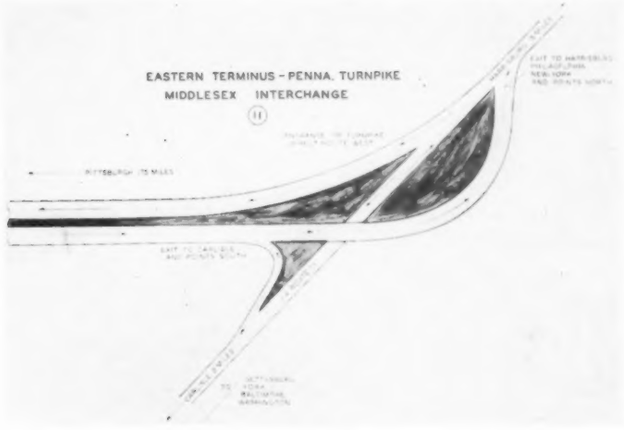
One of the most remarkable highways in the United States was opened this summer when the Pennsylvania Turnpike running 160 miles between Pittsburgh and Harrisburg was completed. Construction of such roads in other parts of the country will have a profound influence, not only on the quantity of motor fuel required, but also on the quality of such fuels.

Above, a view of the 12 mile straight-away, longest stretch of straight road on the superhighway: built over an old railroad right of way, however, there are no sharp turns nor steep grades and safe speeds need be limited only by ability of the automobile to perform safely. At right may be seen the Clear Ridge cut 153 ft. deep and the 100 ft. high fill in Bedford County. On such roads the full economy possible with 100 octane fuel would be available, a subject which is attracting the attention of the current A. P. I. meeting.

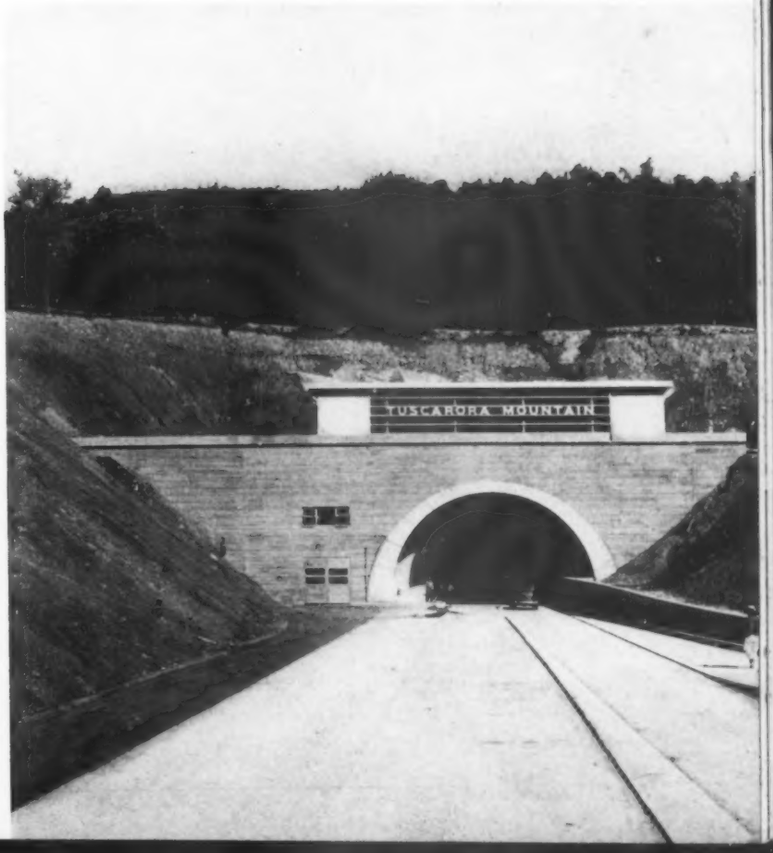
View of the Turnpike in Bedford Narrows, looking east. This natural opening in the mountains is the only point for fifty miles north or south that highway, railroads or streams are permitted east-west direction by the terrain without tunneling. To the right may be seen Lincoln Highway (U.S. Route Number 30).

Midway station dispensing Esso motor fuel and oil, service and rooms. There will be a battery of 24 pumps and two smaller buildings, one of which may be seen in the foreground, will serve as service stations. The larger buildings in the background contains rooms for tourists, and restaurant facilities. For a thousand feet approaching the service center, the turnpike broadens to permit cars to pull out of traffic before slowing down. Every safety feature known to modern highway designers is incorporated in this road which will serve as a model for future construction. The existence of the $12,000,000 railroad right of way was a fortunate chance that enabled the road to be constructed along its present advanced lines.





Above, maps of the two terminals of the Pennsylvania Turnpike showing ideal construction for safety in entering and leaving the road. Right, entrance to one of the many tunnels that eliminate all but the smallest grades. Below, ticket office at the Bedford Interchange mid-point of the 160 mile superhighway; cost of tickets depends on distance travelled on the highway; note curbing that keeps traffic in correct lanes for east or west direction on the turnpike.



Despite the fact that the 160 mile superhighway travels through the broken terrain of Pennsylvania there are no grades steeper than the one shown above. On right may be seen the interior of one of the many tunnels. While all these tunnels had to be widened and almost entirely re-dug, the crude beginnings had been made on many of them when the original railroad was projected over this route.

This view along the Turnpike shows a typical tunnel notice road sign giving the motorist complete information at all times and well in advance. Such precautions help to make the superhighway capable of handling traffic at speeds hitherto unknown on public roads in the United States.

Another Esso station on the Pittsburgh-Harrisburg Turnpike. Note the long leads extending down the road from the station which enables automobiles to reduce speed after leaving through-traffic lanes. Speeds over the new 160 mile road will rival or exceed those possible with trains.

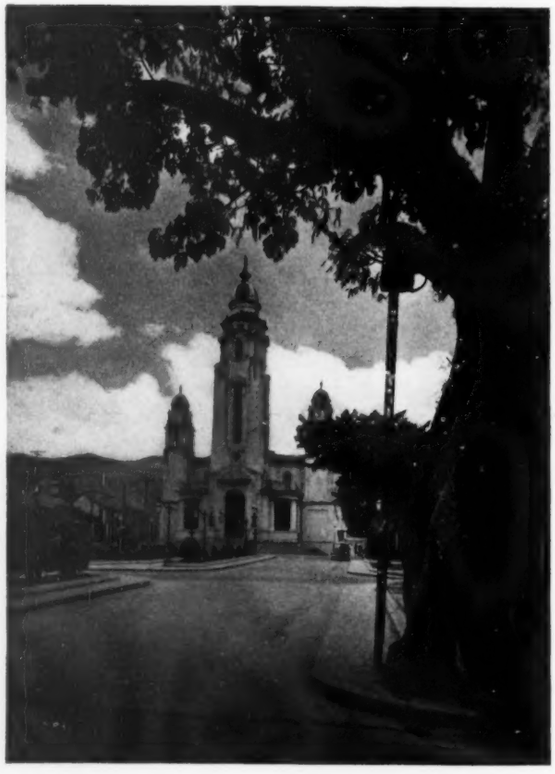
Another road sign notifying the motorist of an exit ahead. Note particularly the distances in advance that such signs are placed permitting action even at unusually high speeds. Below right, the highway enters Blue Mountain tunnel, the first one going west from Harrisburg. When workmen arrived to open these old tunnels they found many of them collapsed, entrances buried under rock slides and covered with brush. Below, an aerial view of the Mount Dallas cut showing the route of the Turnpike, a branch of the Juanita River and the present Lincoln Highway U. S. Route 30 near Everett, Pennsylvania.

Venezuela's Progress Under Lopez Contreras

In the courtyard of one of the federal government buildings in Caracas.

AT THIS moment when there is a genuine desire among the peoples of the two American continents for a better understanding of one another's culture, living conditions and political ideals a new volume on Venezuela is most appropriately timed. It is written by Henry J. Allen, journalist and traveler, former Governor of Kansas and special adviser to the State Department of the United States. He calls his book, "Venezuela —a Democracy" but it might equally well be titled "Venezuela Today" for it is really a chronicle of the forward march of the Venezuelan people under the sound and liberal leadership of President Eleazar Lopez Contreras. One of the most interesting chapters in the book is that in which the author tells of an interview with the President in which the latter explained his great desire to improve the health, education and general well-being of the 65 percent of the population who have had the fewest opportunities in the past. There is something very forthright and appealing about this Chief Executive who could easily have become a dictator but who prefers to lead his people along the democratic way of life and to prepare them to follow it in future.

An ancient and historic church in Caracas.



Mr. Allen was greatly impressed by the attention being given to works of public health, sanitation, housing and education in Venezuela and devotes much space to a description of these various activities. The funds which make them possible, whether they are being carried on as public works or through private initiative, come very largely from the oil industry, either in the form of government revenues or through expenditures by oil companies for their own workers. Oil of course is the mainspring of the national economy of Venezuela and has enabled the country to reach the proud position of a debt-free nation.

The development of the Venezuelan oil industry is traced briefly by Mr. Allen and he gives a picture of life in the oil camps (which of course are not camps in the ordinary sense of the term but thoroughly modern and up-to-date towns) with particular attention to the conditions under which the laborers live and work.

"The root of the oil companies' labor policy" he says, "is that increased earning capacity and improved living conditions depend on the industry's prosperity as well as the individual's growing skill at his trade. Every one of the numerous benefits enjoyed by oil workers, and there are many, has been adopted as a matter of good business and not out of philanthropy."

The status of labor in the oil fields of Venezuela, says Mr. Allen, is comparable to that of workers anywhere else in the world. The minimum wage for unskilled workers is higher than the rate established by the Wage and Hour law in the United States. Wages paid to oil workers are much higher than those paid by other industries in Venezuela.

Labor relations are good because of an unusual spirit and management. The companies follow the policy of employing Venezuelans, so far as possible, and of advancing them to the more responsible and better paid positions as fast as they acquire the necessary skill. How far this development has progressed is indicated by the fact that foreign drillers are no longer employed to any extent except for very difficult exploration work. This speaks well for the aptitude of the Venezuelans since the job of the driller, as is well known in the industry, is the most highly skilled of all field work.

"On top of wages," writes Mr. Allen, "oil companies are now required by law to provide housing, schools and medical attention for employees; as a matter of fact some companies have been doing this on their own initiative for ten years or more.

"Originally houses were constructed by the companies in isolated areas in order to set an example of better housing and to improve the sanitary and living conditions of employees. Swamps were drained, mosquito-breeding streams sprayed, pure water and sanitary facilities provided. In neighboring public villages the companies frequently lent a hand in providing more healthful living conditions.

"The sanitary, medical and housing accomplishments of the oil industry in the jungles make an inspiring story—comparable to fighting yellow fever and malaria in the construction of the Panama Canal. In some sections of the country the hospitals in the oil camps are the only ones available, and the company doctors treat patients from the villages as well as employees and their families.

"There are unions in the oil fields (or syndicates, as they are known) as elsewhere in Venezuela. Their rights are strictly defined by law—but so are their limitations. When syndicate leaders are found to be using their organization's influence for political purposes instead of for the benefit of the workers in smoothing out any differences between employer and employees, the government cracks down.

"Labor relations in the oil industry generally fall into the co-operative group in which the workers deal with the management directly or through representatives of their own choosing. As a result of these talks, which impress me as being along lines of mutual co-operation rather than mutual antagonism, a number of improvements in labor policy, as well as certain wage adjustments, have been worked out. Some of the more important labor practices followed by most of the oil companies might be summarized as follows:

(1) Fair and just treatment for all employees, with individual or collective dealing on a co-operative basis.

(2) A definite procedure for speedy adjustment of grievances without fear of discrimination for having raised the question.

(3) No discrimination against an employee on account of membership or non-membership in any church, society, fraternity or union.

(4) Hiring and promotion solely on the basis of the employee's ability to do his job and his willingness to abide by the rules of the company.

Above, typical dwelling of the rural sections of Venezuela; introducing schools, medicine and improving housing conditions are primary objectives of the present administration: right, a corner of the Plaza Bolivar, in the heart of the capital. Photographs on this and the facing page were taken for World Petroleum by Robert Yarnall Richie.

(5) Protection of each employee against losing his job by limiting discharge only to serious infractions of the posted company rules; warning notice in writing in all other disciplinary cases before discharge.
(6) At least the prevailing scale of wages for similar work in the area.
(7) Eight-hour day.
(8) Safe and sanitary conditions.
(9) Equal treatment for those doing similar classes of work.
(10) Opportunity for special training to qualify for better jobs.
(11) Development of an effective housing program for workers.
(12) Co-operation with employees for sports, social activities and development of mutual plans for social security.

" 'Going to school' in an oil camp is by no means confined to children of the workers. All workers receive job training and in this manner Venezuelan artisans have been developed in every oil-field trade, including the highly skilled and technical job of drilling. For older boys trade schools and manual training are now under consideration. Foremen conferences are conducted regularly to train men in responsible leadership.

Recognizing that friendly understanding between Venezuelans and foreigners was impossible as long as the language barrier stood in the way, the oil companies have arranged for Spanish instructions in the various camps and at the present time practically all foreign employees who do not already speak the language, are taking an intensive course in Spanish. For the most part the employee does this on company time.

"At the moment, the oil industry in Venezuela has no major labor problems. This is true very largely because of the growing tendency of management, labor and the government to recognize as the first principle that the welfare of labor and management is dependent on the prosperity of the industry in which they both are engaged. The situation is a heaven compared to Mexico where the laborer stands in confused and unrequited idleness amidst the industrial bankruptcy his radical leaders have brought upon him."

Venezuela—a Democracy, by Henry J. Allen; 289 pp with map and illustrations. Published by Doubleday, Doran, 14 West 49th Street, New York; $3.50.

Calls Proposed SOUTH AMERICAN INSTITUTE Plan for Nationalization

Writer Declares That Project is Intended to Extend Government Ownership and to Eliminate Private Operation in Southern Continent.

In the September number of World Petroleum was included a paper outlining a project for the organization of a South American Institute of Petroleum. This paper was condensed from a communication received from Engineer C. R. Vegh Garzon, general manager of the A.N.C.A.P. refinery at Montevideo, Uruguay.

World Petroleum is now in receipt of a communication criticising the published report as not fully presenting the purposes of the organization proposed by Dr. Vegh Garzon and criticising the proposal itself as designed primarily to promote the nationalization of the oil industry throughout the South American continent.

The author of this communication has spent many years in South America, is familiar with conditions there and as a student of economics has followed the development of the oil industry there. For this reason and in accordance with its established policy of encouraging full discussion of subjects affecting the oil industry, World Petroleum presents this communication as received. — Editor.

IN THE September issue of WORLD PETROLEUM, under the caption "Proposed South American Institute of Petroleum", an article was published which was based on a communication sent to WORLD PETROLEUM by Engineer C. R. Vegh Garzon, who is general manager of the A. N. C. A. P., official agency of the Uruguayan Government for the exclusive exploration, production and refining of petroleum. In his communication to WORLD PETROLEUM, Dr. Vegh Garzon outlined the reasons which he considers justify the formation of a South American Institute of Petroleum and he touched on the functions which the Institute should perform as well as the procedure which should be followed in securing the cooperation of the South American countries in the formation of such an Institute. While there may be a useful field in South America for a technical organization operating as do the Institutes in the United States and the United Kingdom I want to call attention to the fact that the complete project submitted by Dr. Vegh Garzon to the Executive Council of the South American Union of Engineering Associations contemplates something quite different. In this unabridged project, which has been distributed among government oil agencies and certain technical societies in South America, Dr. Vegh Garzon envisages a South American Institute of Petroleum which will have as its primary and peculiar purpose the elimination of foreign capital in the development of South American petroleum. The A. N. C. A. P. manager calls the process "nationalization". This basic feature of the project, which is completely incompatible with the aims of a nominally technical society to be known as the South American Institute of Petroleum, deserves special study.

After referring to the United States as the pioneer of the oil industry and explaining that South America's interest in the subject has, consequently, been directed almost exclusively toward the United States in the past rather than to a mutual exchange of information among the different South American countries, Dr. Vegh Garzon states in the project which has been circularized throughout South America:

> "This situation has been due to the fact that until a few years ago the production and industrialization of petroleum in South America was exclusively in the hands of foreign enterprises whose connections were also in foreign countries and consequently removed from the scientific, commercial and industrial activities of our continent."

According to Dr. Vegh Garzon's arbitrary assumption this situation has changed and the South American countries are now anxious "to make themselves independent of the intervention of foreign companies, foreign capital and even foreign nations".

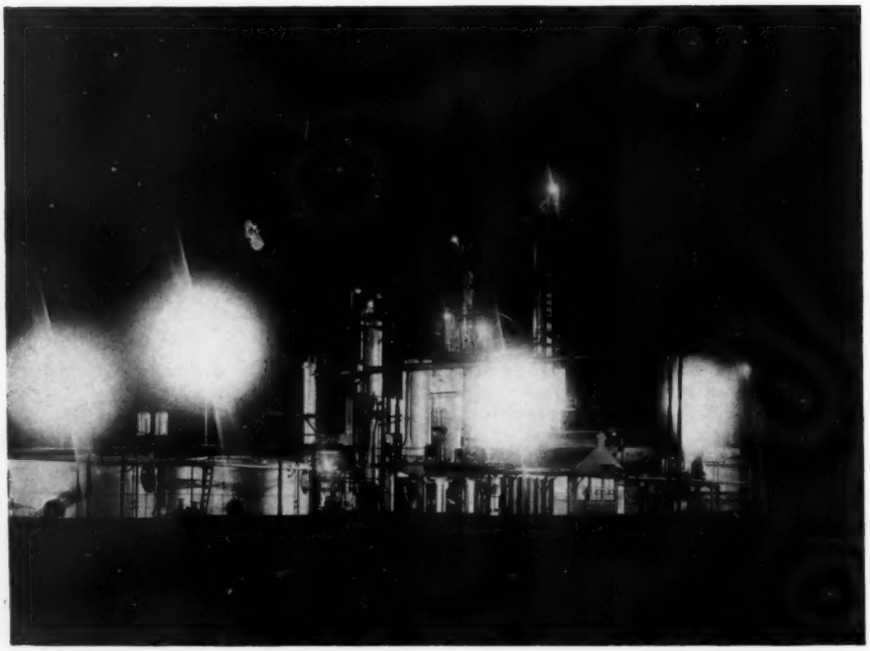
The complete text of the Vegh Garzon proposal makes it clear that what he is sponsoring is not a Petroleum Institute which will foster the exchange of scientific, technical and industrial information, but a political society for the propagation of a chauvinistic nationalism which, without even considering the pros and cons of government operation, is to be organized on the preconceived notion that government operation is good and foreign capital is bad. To support his *a priori* conclusions, Dr. Vegh Garzon refers in great detail to the allegedly nationalistic tendencies in certain South American countries which he frequently exaggerates and misinterprets. These tendencies are invariably extolled as being uniformly beneficial to the countries involved. Thus the manager of the Uruguayan petroleum monoploy states that Bolivia "has in the last few years followed a policy of nationalizing its oil riches and has developed the exploitation of this wealth in a form which is notably favorable to the interests of the country. This development is continuing at the present time with encouraging prospects".

The facts are quite different. Although it is true that Bolivia confiscated oilfields which had been developed by a North American petroleum company, it is a grave mistake to assume that they are being developed "in a manner which is favorable to the interests of the country". A recent government investigation of the official agency in charge of the oil industry disclosed serious waste, gross mismanagement and costly inefficiency, without any compensating benefits. All evidence indicates that the Bolivian Government has incurred large and needless expense in attempting to operate these fields, and any impartial observer will recognize that the so-called "nationalization of its riches" was anything but "favorable to the interest of the country". Two years ago the Uruguayan Government, of which Dr. Vegh Garzon is a member, formally arranged to barter Uruguayan wheat for Bolivian petroleum to be delivered within one year. Bolivia received the wheat but was never able to deliver a single barrel of oil and paid for the wheat in cash. No oil has ever been exported from Bolivia to this day. Dr. Vegh Garzon, who knows these facts, should find it difficult to justify "nationalization" in the case of Bolivia.

Referring to his own country, Dr. Vegh Garzon states: "Uruguay, a country which does not produce petroleum, has in spite of this fact also adopted a nationalistic policy in this matter, by means of the industrialization of the raw material acquired from abroad. The results with respect to the national economy have been completely favorable to the extent that it has served as an example to the other South American countries."

Under its nationalistic policy Uruguay has established a refinery which is operated by A. N. C. A. P. of which Dr. Vegh Garzon is general manager. It is difficult to see how this refinery can serve as an example to any other South American country. An unbiased analysis will in fact demonstrate that Uruguay and its taxpayers would be better off financially if the refinery were shut down and imported petroleum products again sold to the consumer. The elimination of the refinery would permit the sale of products at lower prices without affecting the government's net income in any way. The fact that Uruguay is a country which does not produce petroleum may also be due to its adoption of the nationalistic policy which is being so enthusiastically lauded by Dr. Vegh Garzon. Only A. N. C. A. P. has the right to drill for oil. The government has financed drilling operations in different parts of the country over a period of years, but, to date, has not produced a single barrel of petroleum.

In a brief reference to Chile, the A. N. C. A. P. manager observes that the Chilean government is also interested in initiating a



Night view of the ANCAP refinery in Uruguay: Dr. Vegh Garzon, manager of ANCAP wrote the communication to which the present article is a reply.

policy of nationalism. In Chile the government has for years retained the exclusive right to search for oil. Like Uruguay, it has financed the drilling of numerous wells but, as yet, has not produced a single barrel of petroleum. The nationalistic policy espoused by Dr. Vegh Garzon as the basis for the proposed South American Institute of Petroleum has produced the same negative results in Chile as in Uruguay.

Dr. Vegh Garzon draws specific attention to Argentina as the outstanding example of the benefits to be derived from government operation in the oil industry. The facts leave his conclusion open to serious doubt. In 1907 the Argentine Government, while drilling for water in Comodoro Rivadiva, was the first discoverer of oil in Argentina. Since then the Argentine Government has been actively interested in attempting to make Argentina self-sufficient as a supplier of its own crude oil requirements. Although 33 years have elapsed since oil was first found and huge sums have been spent by this prosperous country in its search for oil, Argentina still imports about half of its normal requirements. Furthermore, a portion of the limited domestic production is provided by foreign companies which were allowed to participate in the oil industry under more favorable conditions some years ago. During the period that private companies were thus encouraged to develop the country's petroleum resources, the production of indigenous crude oil increased rapidly. When certain restrictions were placed upon the further expansion of private activities, it was the gap between production and consumption which began to increase rapidly.

Of more importance than the countries which Dr. Vegh Garzon mentions as glowing examples of nationalism are those countries which he fails to mention. A careful study of the nations of South America will demonstrate that the only countries able to supply their own petroleum requirements, apart from any consideration of their large export industries are those which have encouraged the investment of private capital for the development of their resources. Contrary to Dr. Vegh Garzon's conclusions, the so-called nationalistic policy has not been an outstanding success in developing petroleum production in any country. Thus the pre-eminent position of Venezuela in the oil industry is due entirely to the fact that it has permitted foreign capital to operate on fair terms, fair to the investors and to the country. Similarly Colombia, Peru and Ecuador have developed their petroleum industries by opening their doors to foreign companies while safeguarding their own national interests.

The dire results of Dr. Vegh Garzon's so-called nationalistic policy are best demonstrated in the case of Mexico. The important petroleum industry of that country, as in Venezuela, Colombia, Peru and Ecuador, was developed entirely by foreign oil companies. Before a nationalistic policy was adopted the Mexican Government regularly received a large share of its income from the oil companies. Since the Mexican government took over the operation of the industry it has not only lost this income entirely, but a statement issued by the official government oil agency predicts a loss for the current year of 160,000,000 pesos. These losses have been incurred despite the fact that neither interest nor amortization payments are being made on the large capital investment. Furthermore, Mexican sources indicate that much of the oil plant now in operation is rapidly deteriorating because of inadequate maintenance and it is generally predicted that a large portion of Mexico's refinery installations will be compelled to shut down within the near future.

In proposing a South American Institute of Petroleum which is to serve as the center of propaganda for the encouragement of government operation in South America and the elimination of foreign oil companies Dr. Vegh Garzon is doing his country and the sister republics a poor service. While the benefits of a technical society for the exchange of information and statistics may be considerable, it is a serious mistake to predicate the formation of any such society upon the false notion that government operation is the ultimate desideratum and that the large oil companies with their capital resources and technical experience should be eliminated.

PHILIPPINE Oil Could Change Far East Politics

By William W. Porter II
Consulting Geologist

Personal Conclusions Reached By The Author During a Visit to The Philippines.

A sugar cane field in Northern Cebu, Philippine Islands where oil prospecting is being carried on. The author maintains that the attractiveness of the Philippines for the Japanese would be vastly increased by the discovery of oil and political or at least economic domination would follow if the United States continues with its plan to give the Islands complete independence in 1946.

AN attempt is now being made to develop oil in the Philippines, and because of upset world conditions, this particular wildcat well could have far reaching political significance. The economic effect upon the Philippines would, of course, be of important magnitude at the present time because in spite of the abundance of available oil in the United States, war conditions such as the shortage of tankers, have caused the price of fuel oil in the Philippines to rise to about $4.50 per barrel, compared with about 90 cents at San Pedro harbor, California. Of utmost national importance would be the development within the Philippines of a source of fuel oil available to the U. S. navy.

The location of the Philippines, directly in the path of Japanese southward expansion, would give such an oil discovery a strategic significance of grave importance. There is

(Continued on page 66)

WORLD OIL

Figures in U. S. barrels of 42 gal.

U. S. BARRELS

	Oct. 1939	Nov. 1939	Dec. 1939	Jan. 1940	Feb. 1940	March 1940	April 1940	May 1940	June 1940	July 1940	August 1940	Preliminary Figures Sept. 1940
United States	114,197,800	111,887,000	114,808,500	113,140,700	108,668,800	120,075,000	116,046,000	118,283,000	111,690,000	113,244,000	110,523,000	110,191,500
Soviet Union	18,406,932	17,813,160	18,406,932	18,406,932	17,251,723	18,454,796	17,896,740	18,446,875	18,250,000	18,450,000	18,500,000	18,500,000
Venezuela	19,516,845	16,681,881	16,050,535	14,798,667	14,380,134	15,514,962	16,495,995	18,343,406	18,629,609	16,580,129	15,134,616	15,968,520
Iran	6,637,503	6,423,390	6,637,503	6,637,503	6,227,895	6,745,073	6,507,180	6,560,000	6,449,520	6,664,504	6,700,000	6,700,000
Netherland India: Sumatra	3,600,371	3,427,490	3,629,655	3,472,786	3,149,536	3,440,792	3,428,880	3,456,624	3,345,120	3,456,624	3,456,624	3,345,000
Borneo	995,207	1,068,349	1,086,713	1,093,743	1,062,210	1,097,516	1,063,890	1,106,080	1,070,400	1,106,080	1,106,080	1,070,400
Java	556,658	549,926	633,136	561,064	507,207	562,665	537,720	555,582	537,660	555,582	555,582	537,660
Molucca and Other	64,292	62,340	60,550	59,215	62,340	54,021	67,740	62,310	60,300	62,310	62,310	60,300
Rumania	3,842,567	3,743,041	3,842,154	3,786,908	3,595,888	3,818,554	4,422,721	3,830,236	3,682,618	3,812,557	3,687,500	3,650,000
Mexico	4,500,000	3,700,000	3,500,000	3,348,682	3,147,385	3,286,000	3,180,000	3,412,000	3,873,720	2,945,000	3,410,000	3,400,000
Iraq	2,615,129	2,530,770	2,615,129	2,615,129	2,461,723	2,666,713	2,578,020	2,644,362	2,559,060	2,200,000	2,000,000	1,500,000
Colombia	1,860,620	1,918,891	1,871,594	2,484,398	2,025,618	2,203,272	2,192,178	2,427,000	2,200,000	2,200,000	2,200,000	2,000,000
Trinidad	1,636,645	1,583,850	1,636,645	1,636,645	1,529,808	1,633,421	1,580,940	1,634,754	1,659,000	1,684,000	1,710,000	1,750,000
Argentine	1,632,997	1,621,927	1,691,123	1,751,910	1,797,072	1,686,338	1,620,360	1,688,942	1,682,520	1,763,900	1,745,145	1,688,850
Peru	1,154,037	1,116,810	1,154,037	1,154,037	1,071,869	1,139,932	1,097,400	1,143,466	1,106,580	1,143,466	1,143,466	1,106,600
Bahrein	571,673	563,985	632,962	631,644	581,255	636,577	579,078	616,174	602,560	620,486	622,443	601,200
Burma	710,501	753,771	708,054	666,810	629,039	689,750	666,810	679,520	657,600	679,520	679,520	657,600
Canada	816,257	731,209	502,920	486,859	655,586	570,131	634,869	676,486	657,098	877,133	868,651	850,000
Brunei	488,777	473,010	488,777	488,777	456,576	487,661	471,540	487,940	472,200	487,940	487,940	472,200
Great Germany: Old Reich	381,114	368,820	381,114	381,114	360,383	386,508	371,610	384,183	371,790	384,183	384,183	371,800
Ostmark	58,869	56,970	58,869	58,869	57,072	61,721	61,230	61,194	59,220	61,194	61,194	59,200
Slovakia and Moravia	10,137	9,810	10,137	10,137	9,454	10,106	9,780	10,106	9,780	10,106	10,106	9,800
Poland	331,049	320,370	331,049	331,049	310,155	331,669	320,790	331,421	320,730	331,421	331,421	320,700
Japan	223,016	224,494	223,960	225,308	210,801	224,068	216,960	224,719	217,470	224,719	224,719	217,470
British India	229,422	213,270	228,281	197,532	180,351	189,999	180,090	191,611	185,430	191,611	191,611	185,400
Ecuador	193,382	196,808	205,138	204,509	188,024	211,610	208,513	213,000	201,650	207,700	210,676	208,200
Saudi Arabia	512,590	313,757	437,020	491,663	323,416	606,201	476,359	334,728	356,571	478,243	425,829	467,900
Sarawak	112,716	109,080	112,716	112,716	104,951	112,282	108,330	112,282	108,660	112,282	112,282	108,700
Egypt	420,519	434,174	446,846	438,367	376,043	432,729	454,260	435,891	421,830	450,000	450,000	425,000
Italian Empire: Albania	118,358	114,540	118,358	118,358	112,230	123,411	119,250	121,241	117,330	121,241	121,241	117,300
Italy	7,750	7,500	7,000	6,650	6,000	5,500	5,000	5,000	4,400	4,400	4,400	4,000
France	42,470	41,160	42,532	42,532	39,817	42,439	41,100	42,470	41,100	42,470	42,470	41,100
Hungary	75,000	80,000	85,000	90,000	100,000	110,000	120,000	135,000	150,000	160,000	170,000	180,000
Bolivia	8,556	8,280	8,556	8,556	7,975	8,587	8,310	9,000	9,500	8,556	10,000	10,000
Other Countries	49,073	47,490	49,073	49,073	45,849	49,786	48,150	49,383	47,790	49,383	49,383	47,800
WORLD TOTAL	186,608,832	179,197,323	182,702,568	179,988,842	171,694,185	187,669 690	183,717,793	188,717,542	181,808,316	181,371,684	177,392,392	176,824,339

Where official figures are unobtainable because of existing conditions estimates based on best available private information are given.

Daily Averages in Barrels

	Jan.—September 1940	1939
United States	3,729,421	3,382,274
Soviet Union	599,120	593,772
Venezuela	532,284	562,397
Iran	216,027	214,113
Netherland India: Sumatra	111,504	113,184
Borneo	35,680	36,210
Java	17,922	17,688
Molucca and Other	2,010	2,339
Rumania	125,134	126,388
Mexico	108,313	101,568
Iraq	77,463	84,359
Colombia	72,746	60,020
Trinidad	54,082	52,795
Argentine	56,295	50,508
Peru	36,886	37,227
Bahrein	20,041	21,318
Burma	21,920	20,263
Canada	22,907	21,198
Brunei	15,740	15,812
Great Germany: Old Reich	12,393	12,294
Ostmark	1,974	1,899
Slovakia and Moravia	326	327
Poland	10,691	10,679
Japan	7,249	7,258
British India	6,181	5,929
Ecuador	6,766	6,288
Saudi Arabia	14,455	9,492
Sarawak	3,622	3,645
Egypt	14,175	12,096
Italian Empire: Albania	3,911	3,806
Italy	165	249
France	1,370	1,372
Hungary	4,434	2,107
Bolivia	293	276
Other Countries	1,593	1,583
WORLD TOTAL	5,945,929	5,592,584

Official Crude Oil Production Figures for 1933 to 1939 (Revised) in Barrels

	1939	1938	1937	1936	1935	1934	1933
United States	1,264,256,000	1,214,355,000	1,279,160,000	1,098,516,000	996,596,000	908,065,000	905,656,000
Soviet Union	216,727,024	206,192,000	201,856,661	199,635,921	184,008,033	175,635,783	155,596,429
Venezuela	205,783,585	188,429,050	187,675,477	155,270,840	148,809,057	136,098,681	117,113,960
Iran	78,151,332	78,320,840	78,109,001	62,977,950	57,520,488	57,902,092	54,440,075
Netherland India: Sumatra	41,557,020	34,538,128	33,451,511	30,469,428	28,004,595	26,336,011	22,345,172
Borneo	13,125,425	12,812,383	12,960,072	13,068,910	13,529,185	14,335,543	15,003,175
Java	6,568,660	6,955,283	7,152,931	3,618,293	3,462,440	3,778,920	3,660,810
Molucca and Other	836,144	607,622	537,436	375,823	311,872	273,698	285,335
Rumania	45,931,846	48,366,000	52,395,725	63,532,846	61,270,072	61,849,306	53,919,700
Mexico	39,428,141	38,505,824	46,455,687	41,027,915	40,240,563	38,171,946	34,000,820
Iraq	30,791,132	32,404,000	30,603,660	29,913,150	27,410,983	7,639, 84	1,094,915
Colombia	22,036,613	21,581,588	20,297,543	18,756,110	17,597,655	17,337,900	13,156,125
Trinidad	19,270,256	17,736,176	15,502,989	13,237,030	11,671,224	10,894,363	9,561,353
Argentine	18,613,167	17,076,237	16,354,717	15,457,960	14,297,025	14,021,901	13,660,554
Peru	13,587,906	15,908,279	17,459,112	17,593,069	17,056,555	16,314,381	13,257,311
Bahrein	7,588,554	8,297,998	7,762,264	4,644,635	1,264,807	285,072	31,377
Burma	7,872,981	7,499,498	7,847,553	7,587,718	7,181,113	7,278,859	7,114,311
Canada	7,837,503	6,965,457	2,996,033	1,507,931	1,447,204	1,410,895	1,145,322
Brunei	5,755,164	5,387,214	4,397,038	3,296,938	3,302,905	2,705,350	2,035,651
Great Germany: Old Reich	4,487,491	3,850,044	3,148,300	3,076,858	2,967,438	2,204,402	1,656,602
Ostmark	693,247	370,038	221,266	50,092	44,347	27,965	5,701
Slovakia and Moravia	119,380	132,005	123,474	126,603	136,580	177,797	121,695
Poland	3,898,044	3,828,438	3,799,862	3,869,575	3,901,881	4,011,336	4,174,079
Japan	2,652,930	2,511,184	2,487,841	2,403,072	2,294,878	1,872,837	1,504,402
British India	2,332,467	2,330,209	2,161,653	1,978,329	2,037,810	1,921,863	1,628,803
Ecuador	2,312,118	2,257,278	2,161,436	1,942,467	1,731,785	1,636,619	1,619,902
Saudi Arabia	3,933,904	495,135	64,968	19,777	Nil	Nil	Nil
Sarawak	1,327,327	1,624,882	1,655,565	1,547,882	1,776,593	1,942,591	2,206,815
Egypt	4,602,797	1,561,231	1,163,267	1,262,666	1,255,151	1,527,252	1,653,535
Italian Empire: Albania	1,393,727	437,597	380,292	219,693	41,218	17,500	11,427
Italy	91,330	106,083	112,700	129,653	128,615	162,449	213,534
France	500,815	516,240	507,067	534,063	529,664	700,000	786,360
Hungary	769,092	330,829	13,910	100	Nil	Nil	Nil
Bolivia	100,885	106,620	123,123	104,746	163,295	157,875	111,973
Other Countries	578,036	243,000	70,000	37,100	32,300	64,000	54,110
WORLD TOTAL	2,075,512,043	1,982,639,390	2,041,170,134	1,797,791,150	1,652,023,331	1,516,760,036	1,438,797,443

PRODUCTION

—Conversion ratios used are weighted averages for individual countries

METRIC TONS

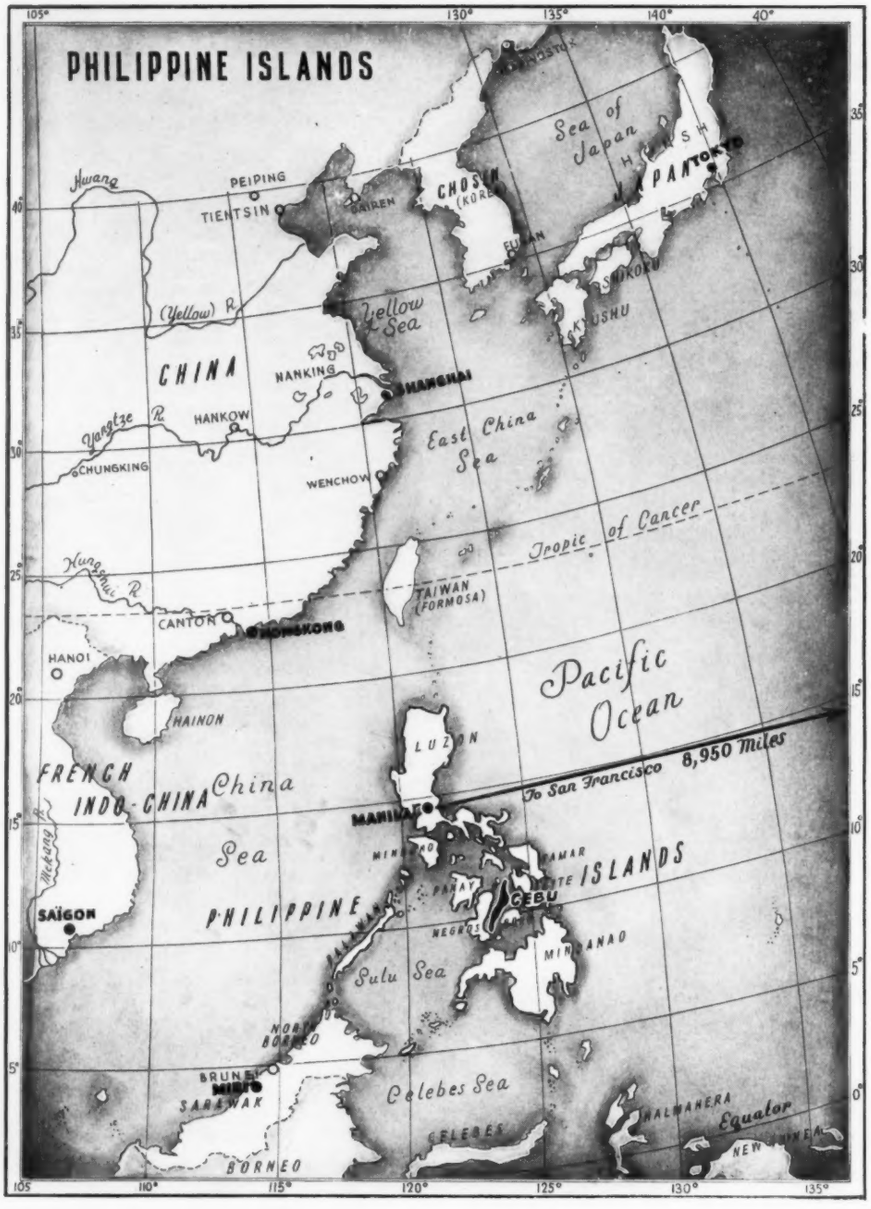
	Oct. 1939	Nov. 1939	Dec. 1939	Jan. 1940	Feb. 1940	March 1940	April 1940	May 1940	June 1940	July 1940	August 1940	Preliminary Figures Sept. 1940
United States	15,450,953	15,138,276	15,533,757	15,307,901	14,702,854	16,246,164	15,700,987	16,003,653	15,111,622	15,321,877	14,953,727	14,908,875
Soviet Union	2,508,024	2,427,120	2,508,024	2,508,024	2,360,194	2,531,522	2,436,780	2,520,083	2,503,429	2,530,864	2,537,722	2,537,722
Venezuela	2,897,824	2,476,894	2,383,153	2,197,278	2,135,135	2,303,632	2,449,294	2,723,594	2,766,089	2,461,786	2,247,159	2,370,960
Iran	880,493	852,090	880,493	880,493	826,152	894,753	863,190	870,212	855,540	884,058	888,784	888,784
Netherland India: Sumatra	460,936	438,803	464,685	444,602	403,218	440,506	438,960	432,525	426,270	440,479	440,479	426,270
Borneo	127,411	136,775	139,126	140,026	135,989	140,509	136,290	141,608	137,040	141,608	141,608	137,040
Java	71,266	70,404	81,057	71,830	64,935	72,035	68,820	71,114	69,210	71,114	71,114	69,210
Molucca and Other	8,231	7,981	7,752	7,581	7,981	6,916	8,670	7,967	7,710	7,967	7,967	7,710
Rumania	521,026	507,531	520,970	513,479	487,578	517,770	599,691	519,354	499,338	516,957	516,000	500,000
Mexico	660,973	543,318	513,950	492,094	462,171	482,525	466,960	501,028	491,923	432,452	500,734	499,265
Iraq	349,556	338,280	349,556	349,556	330,034	356,531	344,670	353,741	342,330	294,000	267,000	200,000
Colombia	257,920	267,627	260,524	346,499	282,512	307,290	305,745	338,493	306,834	306,834	306,834	278,940
Trinidad	230,206	222,780	230,206	230,206	215,151	229,710	222,360	229,896	233,300	236,800	240,000	246,000
Argentine	232,620	231,043	240,900	249,559	255,993	240,219	230,820	240,590	239,675	251,267	248,596	240,570
Peru	152,737	147,810	152,737	152,737	141,810	150,784	145,200	151,280	146,400	151,280	151,280	146,400
Bahrein	78,012	76,963	86,375	86,195	79,319	87,017	79,022	84,084	82,227	84,673	84,940	82,050
Burma	98,135	104,112	97,797	92,101	86,855	94,147	91,980	93,527	90,510	93,527	93,527	90,510
Canada	103,875	93,052	64,001	61,957	83,429	72,554	80,792	86,088	83,621	111,619	110,543	108,000
Brunei	65,193	63,090	65,193	65,193	60,900	65,038	62,880	65,069	62,970	65,038	65,038	62,970
Great Germany: Old Reich	54,963	53,190	54,963	54,963	51,997	55,800	53,940	55,490	53,700	55,490	55,490	53,700
Ostmark	9,331	9,030	9,331	9,331	9,048	9,827	9,780	9,703	9,390	9,703	9,703	9,390
Slovakia and Moravia	1,519	1,470	1,519	1,519	1,421	1,519	1,470	1,519	1,470	1,519	1,519	1,470
Poland	44,392	42,960	44,392	44,392	41,644	44,516	43,050	44,454	43,020	44,454	44,454	43,000
Japan	31,723	31,933	31,857	32,178	30,131	32,023	31,020	32,085	31,050	32,085	32,085	31,000
British India	31,688	29,457	31,530	27,280	24,911	26,226	24,870	26 443	25,590	26,443	26,443	25,590
Ecuador	25,495	25,947	27,045	26,962	24,788	27,898	27,490	28 081	26,585	27,382	27,775	27,475
Saudi Arabia	72,899	42,503	59,201	66,604	43,812	82,120	64,531	45,344	48,304	64,785	57,685	63,385
Sarawak	14,539	14,070	14,539	14,539[1]	13,543	14,415	13,920	14,446	13,980	14,446	14,446	14,000
Egypt	60,057	62,150	63,817	62,606	53,534	58,125	57,150	59,272	57,360	64,267	64,267	60,696
Italian Empire: Albania	17,670	17,100	17,670	17,670	16,762	18,415	17,790	18,073	17,790	18,073	18,104	17,790
Italy	961	930	870	820	750	680	620	620	540	540	540	500
France	5,952	5,760	5,952	5,952	5,568	5,952	5,760	5,952	5,760	5,952	5,952	5,760
Hungary	10,000	10,760	11,435	12,100	13,450	14,800	16,140	18,160	20,180	21,525	22,870	24,200
Bolivia	992	960	992	992	928	992	960	992	1,166	1,231	1,394	1,394
Other Countries	6,975	6,750	6,975	6,975	6,525	7,006	6,780	7,223	6,810	7,223	7,037	6,800
WORLD TOTAL	25,544,547	24,498,919	24,962,344	24,582,194	23,461,022	25,639,936	25,108,382	25,801,763	24,818,733	24,799,318	24,262,816	24,187,426

Daily Averages in Metric Tons

	Jan.—September 1940	1939
United States	504,590	457,618
Soviet Union	81.993	80,904
Venezuela	79,032	83,428
Iran	28,656	28,403
Netherland: India Sumatra	14,209	14,490
Borneo	4,568	4,661
Java	2,296	2,264
Molucca and Other	257	301
Rumania	17,044	17,137
Mexico	15,799	14,930
Iraq	10,357	11,276
Colombia	10,145	8,357
Trinidad	7,603	7,426
Argentine	8,019	7,184
Peru	4,880	4,927
Bahrein	2,735	2 901
Burma	3,017	2,798
Canada	2,914	2,698
Brunei	2,099	2,104
Great Germany: Old Reich	1,790	1,774
Ostmark	313	301
Slovakia and Moravia	49	49
Poland	1,434	1,432
Japan	1,035	1,039
British India	853	818
Ecuador	892	836
Saudi Arabia	1,958	1,286
Sarawak	466	469
Egypt	1,960	1,727
Italian Empire: Albania	584	570
Italy	20	31
France	192	192
Hungary	596	283
Bolivia	36	33
Other Countries	227	224
WORLD TOTAL	812.633	764,707

Official Crude Oil Production Figures for 1933 to 1939 (Revised) in Metric Tons

	1939	1938	1937	1936	1935	1934	1933
United States	171,053,443	164,346,325	172,822,797	148,707,864	134,912,143	122,913,903	122,601,191
Soviet Union	29,530,168	28,859,000	27,867,025‡	27,384,900	25,241,100	24,092,700	21,330,100
Venezuela	30,533,706	27,845,286	27,733,926	22,945,299	21,990,373	20,112,115	17,293,193
Iran	10,367,112	10,358,495	10,330,480	8,329,289	7,607,500	7,657,970	7,200,093
Netherland India: Sumatra	5,320,320	4,662,836	4,490,137	4,114,710	3,759,006	3,535,035	2,999,352
Borneo	1,680,377	1,719,783	1,739,607	1,773,545	1,815,998	1,924,234	2,013,849
Java	840,950	933,595	960,125	499,097	464,757	510,320	483,331
Molucca and Other	107,047	81,560	72,139	50,446	41,862	36 738	38,300
Rumania	6,228,047	6,603,000	7,153,000	8,704,000	8,394,000	8,473,355	7,387,000
Mexico	5,794,215	5,716,423	6,896,657	6,090,842	5,973,955	5,666,857	5,049,109
Iraq	4,115,845	4,345,000	4,126,185	4,079,066	3,724,231	1,048,108	147,943
Colombia	3,067,568	3,007,935	2,844,251	2,614,092	2,452,635	2,416,432	1,833,606
Trinidad	2,710,515	2,472,943	2,181,676	1,862,796	1,642,446	1,533,122	1,345,532
Argentina	2,651,448	2,432,857	2,330,063	2,202,304	2,036,903	1,997,706	1,950,499
Peru	1,798,557	9,099,885	2,313,691	2,331,454	2,260,903	2,161,990	1,756,867
Bahrein	1,033,472	1,130,734	1,058,557	635,555	173,072	39,008	4,293
Burma	1,087,424	1,039,960	1,083,391	1,047,593	991,456	1,004,951	982,233
Canada	997,391	879,921	378,478	190,495	182,820	178,233	144,686
Brunei	767,700	707,123	576,545	470,991	471,842	386,478	290,808
Great Germany: Old Reich	647,337	552,074	453,451	444,600	427,400	317,500	238,600
Ostmark	109,904	63,468	33,010	7,473	6,616	4,172	860
Slovakia and Moravia	18,103	19,282	18,036	18,665	19,946	25,971	17,776
Poland	522,874	504,678	501,301	510,630	614,760	529,200	550,670
Japan	379,161	356,328	341,040	341,976	326,580	266,520	212,667
British India	322,160	322,125	298,450	273,137	281,072	265,341	224,879
Ecuador	306,824	319,877	306,326	275,293	245,434	231,947	229,578
Saudi Arabia	536,366	66,683	8,070	2,447	Nil	Nil	Nil
Sarawak	171,322	200,126	217,085	221,126	253,799	277,513	315,259
Egypt	657,510	223,058	166,298	177,491	176,436	214,671	232,437
Italian Empire: Albania	208,279	65,313	56,760	32,760	6,152	2,500	1,707
Italy	11,346	13,178	14,000	16,106	15,977	20,180	26,526
France	70,224	72,106	71,008	74,788	74,172	98,025	110,120
Hungary	103,364	42,798	13,910	13	Nil	Nil	Nil
Bolivia	11,904	13,262	15,487	13,197	20,540	19,858	14,085
Other Countries	82,300	34,080	10,000	5,300	4,600	9,100	7,700
WORLD TOTAL	283,844,283	279,111,097	279,482,962	246,449,340	226,610,486	207,971,753	197,034,849



Map of the Philippine Islands which are to receive full independence in 1946: the author maintains that such independence would be short lived with an expanding Japanese empire as a close northern neighbor: below, Geological exploration in the Northern Cebu area shown below may result in adding to the wealth of these islands.

certainly no secret about the Japanese totalitarian methods of aggression, nor is there any secret that Japan, in common with the totalitarian powers of Europe, has no important oil reserves. If oil should be discovered in the Philippines, its importance to Japan could hardly be overstated. Such a discovery should therefore focus American attention on the Philippines and thus make the American public and the American Congress conscious of the Philippine problem.

In 1935 the American Congress passed the Philippine Independence Act which gives the islands complete independence in 1946. Now, with the shadow of an aggressive Japanese military regime cast over all of "Greater East Asia", only an incorrigible idealistic optimist can believe that an Independent Philippines will long exist before coming under Japanese domination. Whether this domination be through military conquest or simply by "penetration" the practical result is the same. The Japanese will move in and take over. This predicament should be well considered by those who believe that as a matter of principle the Philippines are entitled to independence. It should be understood that so far as the Filipino people are concerned, the gift of independence is actually a gift to Japan of gold, food, manganese, chromium, iron, living space, hemp, and possibly oil. In other words, a gift to unfriendly aggressive militarists of a warehouse of materials from which can be made the war machine and armaments of attack. American interest in the Philippines may be less in the intrinsic value of the islands, and more in the strategic value of control over potential resources which are of vital importance to our competitors. We can entirely discard any qualms of conscience which would incline us to give independence because we owe it and they want it. The Filipinos as a people emphatically do not want it, as anyone can learn from inquiring from the people, themselves. Rather than appreciation, they feel the fear that independence will really mean their abandonment to the fates of Korea, Manchuria, and North China.

An oil discovery may give impetus to the movement for re-examination of the Philippine problem, and an oil discovery is not improbable. The islands contain some 15,000 feet of marine Miocene and Pliocene sediments which contain oil in Borneo a short distance to the southwest. There are suitable anticlinal folds, and numerous oil seepages, one which the writer visited—a hundred foot exposure of oil sand—has supplied paving for the streets of Manila and Cebu for many years. Far East Oil Development Company's wildcat test on the north end of Cebu island will therefore be watched with interest.

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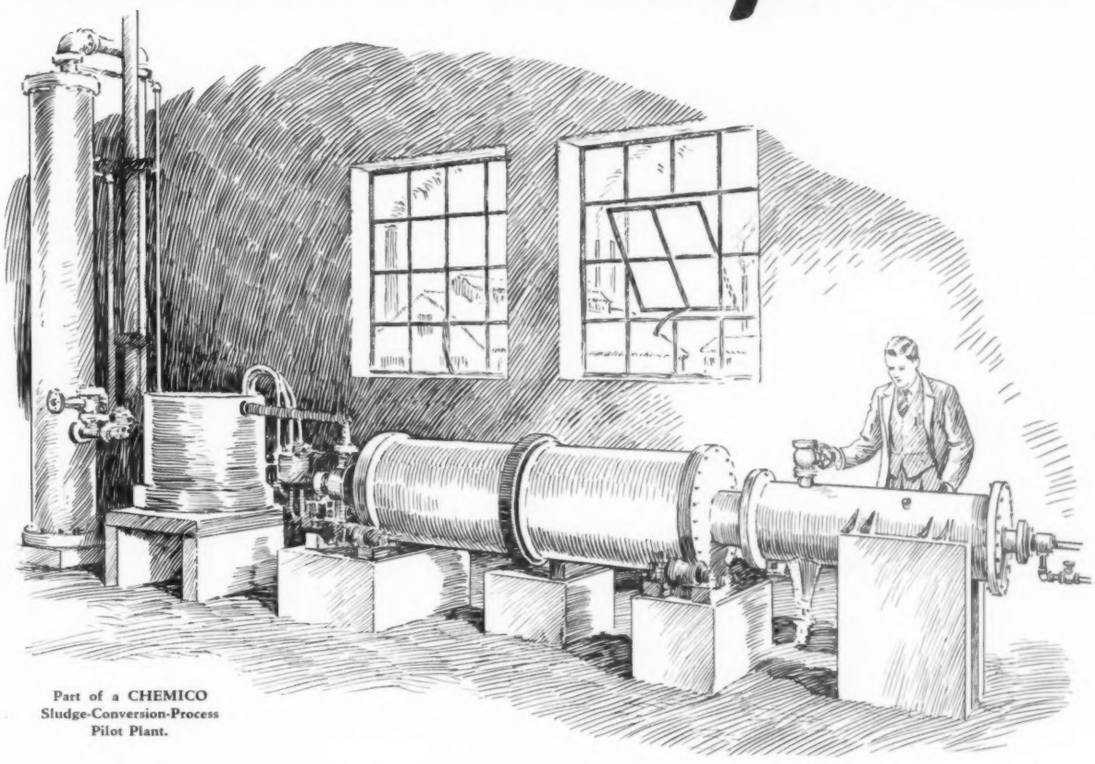

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Foreign Oil Legion

J. E. F. DeKok

AN able engineer who was at the same time an outstanding figure both in aviation and in the oil industry passed from the scene with the death of J. E. F. DeKok, former managing director of the Royal Dutch Company, which occurred at The Hague on October 28.

Though he served for several years as the executive head of one of the two largest oil companies in the world Mr. DeKok was a man of retiring disposition with a strong aversion to personal publicity and preferred to keep himself in the background as much as possible. Of fine physical and boundless energy, he was, however, a hard worker who kept in close contact with the world wide activities of his organization, and his conspicuous abilities were recognized throughout the oil industry and by all the citizens of his own country to whom he had rendered many noteworthy services.

Born in 1882 Mr. DeKok was educated at the Royal Military Academy and began his career in the Netherlands Indian Army. After a short service abroad he was sent home on sick leave. During this period he began the study of chemistry and became so much interested that he decided to leave the army and to fit himself for the engineering profession. He entered the University of Delft where he obtained a diploma as technical engineer with highest honors.

In 1908 Mr. DeKok joined the Royal Dutch Company and became manager of the laboratories at Rotterdam and Amsterdam. As the result of research in the chemistry of petroleum conducted there, he was of great assistance to the Allies during the World War in the production of trinitrotoluol and other basic materials for explosives.

From his position at the head of the technical department Mr. DeKok was advanced in 1921 to managing director of the Royal Dutch and continued in that position until 1937 when he succeeded Sir Henri Deterding in the leadership of the entire group of companies headed by Royal Dutch.

Mr. DeKok was an aviation enthusiast. He became a licensed air pilot at 50 and made many long distance flights in his own plane including one to Netherlands India and another to Cape Town. He did much to encourage private flying and civil aviation in the Netherlands and was responsible for the acquisition and equipment of the airdrome at Yprenburg which was primarily intended to be the home of Dutch private aviation. He was actively concerned with the development of the Dutch national flying school, assisted the flying schools in Netherlands India and at Curacao, and took an active part in the creation of a reserve of young pilots for military training. He was president of the Aero Club of the Netherlands until last year and was chairman of the board of K L M, the well known Dutch aviation company.

VISCOUNT BEARSTED, British petroleum executive and chairman of Shell Transport and Trading Co., Ltd., who arrived in New York by Pan American transatlantic clipper on Monday, October 21st, and left

Viscount Bearsted

for the Pacific Coast on the 25th, said that lack of lubricants might prove more dangerous to Germany in the prosecution of the war than the supposed lack of high octane aviation fuel. Lord Bearsted pointed out that it would be very difficult to establish the time when such a shortage might become evident as it depended largely on the course of the war. It would first become apparent in an increase in motor trouble. He did not feel that the occupation of conquered territory added significantly to Germany's oil supplies.

J. S. BERNARD, refinery construction engineer with M. W. Kellogg Company, returned via the Cape of Good Hope to the United States on October 16 from Haifa, Palestine, where about 450 other Americans are said to have been employed building the new plant for Consolidated Oil Refineries Ltd. (Shell and Anglo-Iranian). Mr. Bernard told newspaper reporters that the Italians bombed the plant four times before his ship (the Egyptian flag vessel EL NIL) sailed from Alexandria two months before, and that there was hardly any interference with the bombers owing to the lack of anti-aircraft guns.

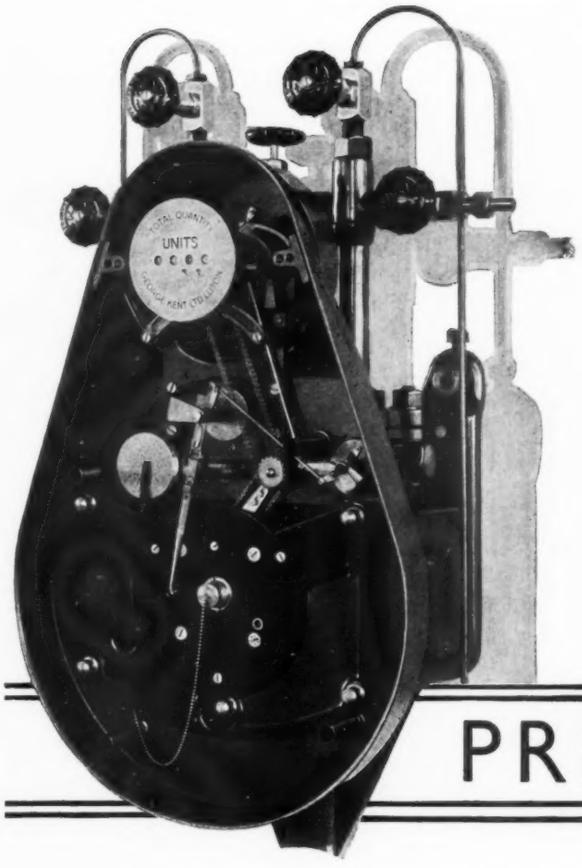
Cosmo-Silles

Gordon M. Michler, executive of the Standard Oil Company of New Jersey pictured on his arrival in New York harbor on the SS. Santa Lucia on Monday, October 21st after a three months' trip through South America.

Cosmo-Silles

Harold D. Humpstone, president of the West India Oil Company arriving on the SS. Santa Lucia from Chile. Mr. Humpstone was on the same ship that brought Mr. Michler to New York.

HARRY T. KLEIN has been elected executive vice president and general counsel of The Texas Company at a meeting of the board of directors, W. S. S. Rodgers, president, announced. Mr. Klein has been vice president and general counsel of the company since 1933. Mr. Rodgers at the same time announced that C. E. Olmsted, vice president in charge of the company's refining



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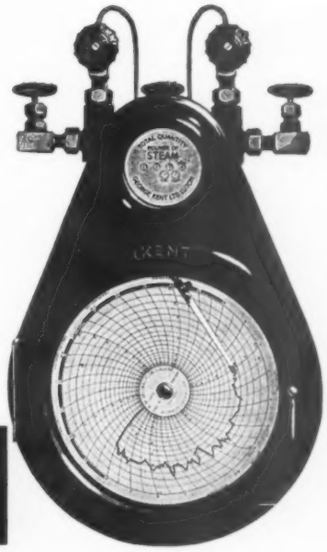


GEORGE KENT

Michael Halpern

department, who was recently elected a director, has been placed in charge of the export department, and that Michael Halpern, general manager of the refining department, has been elected a vice president to assume Mr. Olmsted's position in charge of that department. All three men have had long and distinguished careers with Texaco.

Mr. Halpern takes charge of the refining department after twenty-four years' service in that branch. He joined Texaco in 1916, became civil engineer at the Bayonne Terminal in 1917 and less than four years later assistant superintendent at the Providence Terminal. In 1923 he was made superintendent of Delaware River Terminal, and in 1926 was transferred to Houston as auditor of operations, subsequently serving as an assistant superintendent at the Port Arthur Works, assistant manager of the refining department, with headquarters in New York, and as manager of manufacturing. He also acted for a time as director of research and in September, 1938, was appointed general manager of the refining unit.

L. A. BLUMENTHAL, foreign trade department of the Socony-Vacuum Oil Company, has been loaned to the Company's Eastern U. S. A. division until the European situation clears up. Mr. Blumenthal is studying just how much more business the company should do in each marketing area.

H. A. METZGER, who has spent several years in oil company service in Colombia and other South American countries, returned to the United States early in October and is now stationed at the home office of Standard Oil Company (N. J.) in New York.

Cosmo-Sileo

Mr. and Mrs. Waldo Sheldon sailing on the SS. Santa Paula of the Grace line on October 11. Mr. Sheldon expects to be in Venezuela for the next six months where he is in charge of wildcat drilling operations for Socony-Vacuum. Several wells have already been drilled in the eastern and central part of Venezuela for Socony-Vacuum.

Cosmo-Sileo

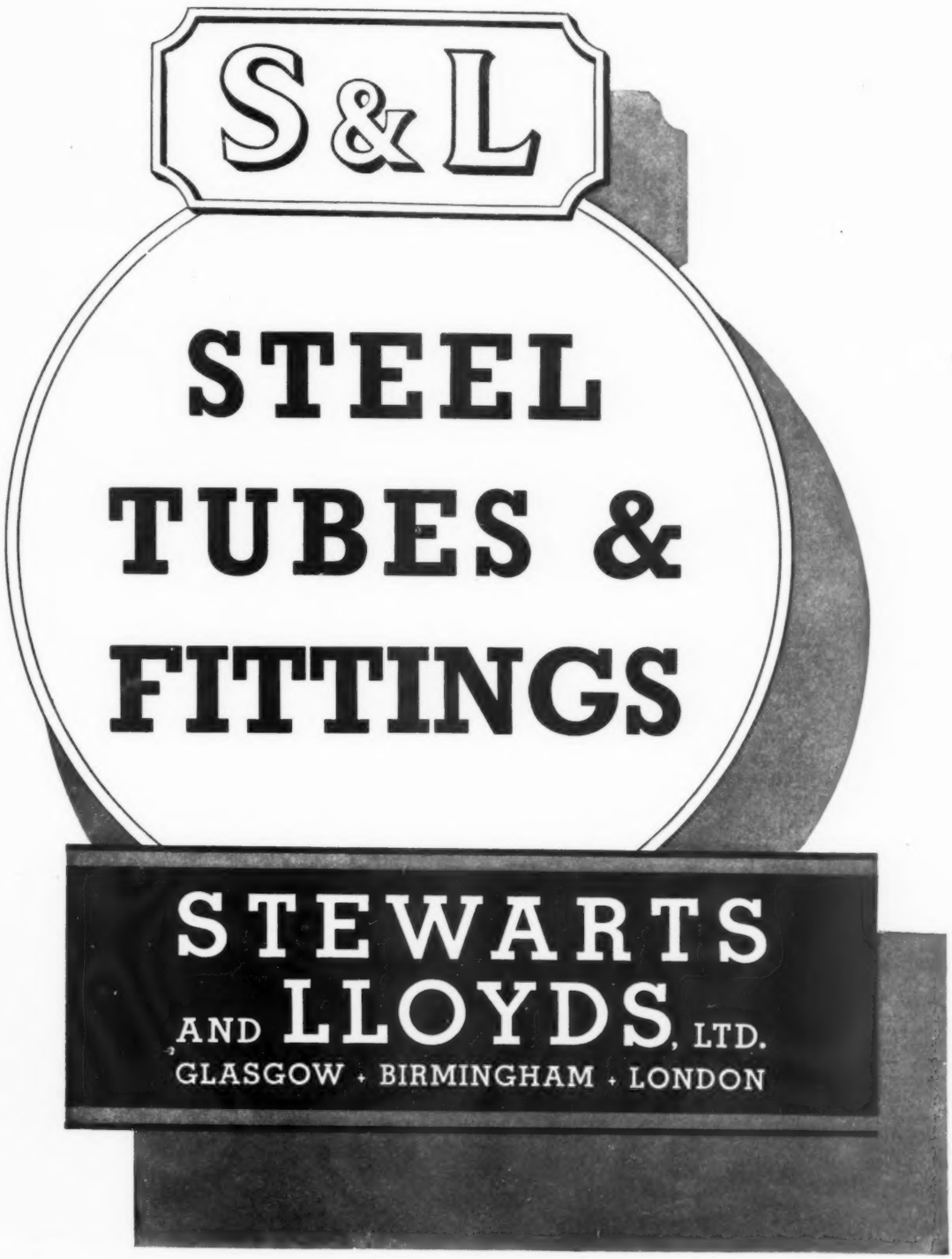
Dr. Charles E. Lanning, executive of the foreign refining division of Standard Oil Company of New Jersey, as he sailed from New York on the 25th of October to Venezuela.

Cosmo-Sileo

C. A. Nation of The Texas Company, also on the Santa Rosa en route to Venezuela.

Cosmo-Sileo

Salvatore V. Gasparina, Gulf Oil Corporation sailing from New York for a three months' business trip in South America on October 25.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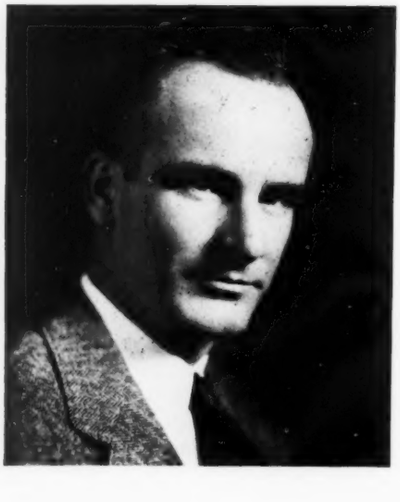
LEFT, HERBERT G. KIESWETTER of United States Rubber Export Company chats with John D. Clarke as he leaves by rail from New York to Miami where he has since embarked on a Pan American clipper for a trip to Brazil and Argentine. One purpose of Mr. Kieswetter's trip to South America is to interview oil men in Argentina.

RIGHT, A. R. WEIS, formerly vice president of Pacific Pump works has been made president of that company which has been acquired by Dresser Manufacturing Company. Mr. Weis will serve on the board of directors of the Dresser Company which was organized in 1880 to manufacture materials for pipelines. Pacific Pump Company was established at Huntington Park, California in 1924 and manufactures centrifugal, turbine and deep well plunger pumps for oil country service.



LEFT, RICHARD H. MCPEAKE, recently appointed sales manager of Oil Well Supply Company's export division. Mr. McPeake has spent many years in South America and is thoroughly familiar with the oil equipment market in that area.

BELOW, H. J. FRENCH and T. N. ARMSTRONG JR., receiving the Lincoln Gold Medal from Professor L. W. Clark of Rennsselaer Polytechnic Institute on October 21st at the Twenty-first Annual Meeting of the American Welding Society in Cleveland. The Lincoln medal was donated by James F. Lincoln of the Lincoln Electric Company and the award took place at the largest meeting in the history of the Society. Prizes and medals were awarded for papers on welding technique presented at the meeting.

Alexander Fraser

ALEXANDER FRASER, president of Shell Oil Company announced completion of the decentralization program, which involved the merger of two major marketing units and the enlargement of field sales staffs everywhere east of the Rockies.

Under the new program, all marketing operations in the eastern two-thirds of the United States are handled out of twelve divisional offices, with executive headquarters located in New York City. Refinery operations are handled through the New York office, while exploration and production is centered at Houston, Texas. The Shell Pipe Line Corporation also maintains its head offices in Houston.

Greater facility of operation was given as the primary reason for the move.

Three hundred and twenty families were brought to New York City from St. Louis where the head offices of the mid-west unit were previously located; 270 others have been transferred to the division offices in Boston, Albany, New York, Baltimore, Minneapolis, Chicago, Detroit, Cleveland Indianapolis, St. Louis, Nashville and Atlanta, as well as to the production offices at Houston, Texas, Tulsa, Oklahoma and

E. D. Cummings

Centralia, Illinois, and the refineries at Wood River, Illinois, Houston, Texas and Norco, Louisiana.

Additional space has been taken in the R. C. A. Building, making Shell the third largest tenant in Radio City. This space is under lease until 1954. Arrangements have been completed also for the construction of suitable new division offices in two of the twelve cities and the leasing of considerable additional office space on a long-term basis in the others.

The household effects of the St. Louis employees and their families were transported to New York in 250 motor vans. A special freight train of 44 cars was used to move the St. Louis office equipment. The entire move was handled in less than a week.

F. A. C. GUEPIN of St. Louis, previously vice president of the mid-west company, came to New York as senior vice-president and L. T. KITTINGER of New York City, former marketing vice president of the eastern unit,

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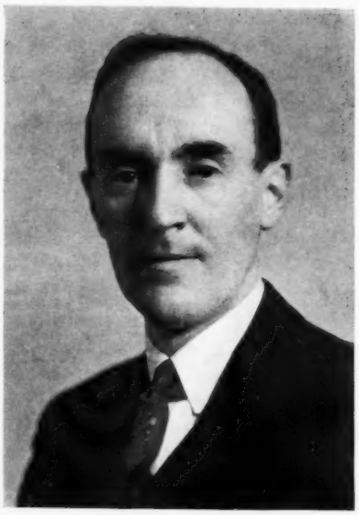

J. W. Watson

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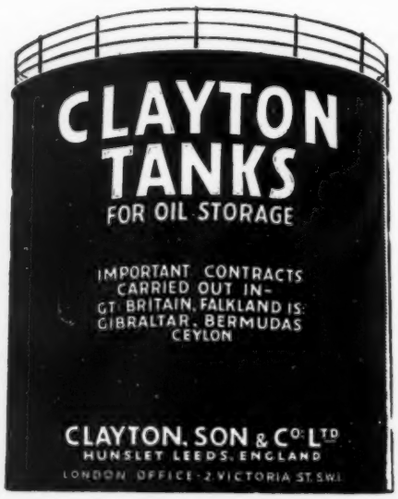

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is continuing in the same position for the entire area east of the Rockies.

Other vice presidents are N. G. McGaw, formerly of St. Louis (transportation and supplies); E. D. Cummings, from St. Louis (manufacturing); R. R. Griffin, New York (marine transportation); H. H. Anderson, from St. Louis (personnel); and P. E. Lakin,

N. G. McGaw

(resident vice president, Chicago). Mr. J. W. Watson also comes from St. Louis to New York as treasurer of the company.

Chester E. Moore has been appointed southwestern sales representative of Arthur G. McKee and Company, refinery engineers of Cleveland, Ohio. Mr. Moore has, until recently been European sales representative for McKee with headquarters in London.

Statement of the Ownership, Management, Circulation, etc. required by the Acts of Congress of August 24, 1912 and March 3, 1933, of World Petroleum published monthly at Hoboken, N. J., for October 1, 1940.

State of New Jersey } ss.
County of Hudson }

Before me, a notary public in and for the State and county aforesaid personally appeared Frank Palmer, who, having been duly sworn according to law, deposes and says that he is the general manager of the World Petroleum and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation) etc., of the aforesaid publication for the date shown in the above caption, required by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business manager are: Publisher, Estate of Russell Palmer, Mona Palmer, Executrix, 2885 Tanoble Drive, Altadena, Calif. Editor, E. W. Mayo, 95 River Street, Hoboken, N. J. Managing Editor, E. W. Mayo, Jr., 95 River St., Hoboken, N. J.: Business Manager, Frank Palmer, 95 River Street, Hoboken, N. J.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders, owning or holding one percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given) Estate of Russell Palmer, Mona Palmer, Executrix, 2885 Tanoble Drive, Altadena, Calif.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state). None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

Frank Palmer
(Signature of General Manager)

Sworn to and subscribed before me this 15th day of October 1940.

[seal] Joseph A. Giangardella
(My commission expires June 28, 1945)